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OPERATIONS AND MAINTENANCE MANUAL FOR EXPANDED BIOVENTING SYSTEM

SWMU 55 (SITE FT-03)
FORMER FIRE PROTECTION TRAINING AREA NO. 3
CHARLESTON AIR FORCE BASE
CHARLESTON, SOUTH CAROLINA

PREPARED FOR:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
TECHNOLOGY TRANSFER DIVISION
BROOKS AIR FORCE BASE
SAN ANTONIO, TEXAS

AND

437 CES/CEV
CHARLESTON AIR FORCE BASE
CHARLESTON, SOUTH CAROLINA

OCTOBER 1997

PARSONS ENGINEERING INC

AQM01-03-0516

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Parsons Engineering Science, Inc. • A Unit of Parsons Infrastructure & Technology Group Inc.
401 Harrison Oaks Boulevard, Suite 210 • Cary, North Carolina 27513 • (919) 677-0080 • Fax: (919) 677-0118

October 30, 1997

Major Ed Marchand
AFCEE/ERT
3207 North Road, Bldg. 532
Brooks AFB, Texas 78235-5363

Subject: Operation and Maintenance Manual, Record Drawings, and Summary of Initial Results for the Expanded Bioventing System Installed at SWMU 55 (IRP Site FT-03), Charleston AFB, SC
(Contract F41624-92-8036, Delivery Order 17)

Dear Major Marchand:

This letter transmits three copies of the Operation and Maintenance (O&M) Manual prepared for the expanded bioventing system recently installed at SWMU 55, also known as IRP Site FT-03 (Former Fire Training Area 3), located at Charleston Air Force Base (AFB), South Carolina. Throughout this letter report, the site will be referenced as Site FT-03 for consistency with previous AFCEE-funded bioventing studies and reports for this site. Appendix A of the O&M Manual contains record drawings for the installed system.

This letter report also provides a summary of the work performed by Parsons Engineering Science, Inc. (Parsons ES) at the site from February through June 1997. Included in this report are the initial bioventing system operating parameters and sampling results. Copies of this letter and the O&M Manual also have been sent to Mr. Al Urrutia, the point of contact at Charleston AFB.

Summary of Field Activities

In October 1992, Parsons ES (formerly Engineering-Science Inc. [ES]) installed a bioventing pilot test system at Site FT-03 to remediate soils impacted by jet fuels, reclaimable mixed fuels, and other flammable wastes that were used during fire training exercises at the site. The pilot-scale system was composed of one 4-inch diameter horizontal vent well (HVW), four permanent soil vapor monitoring points (MPs) and several temporary soil MPs installed in fuel-impacted soils on the north side of the burn pit. A single 1-HP blower was used for the pilot-scale system. The pilot-scale system was operated and monitored by Parsons ES as a pilot study for one year, from November 1992 through November 1993. Following the one-year pilot study, the Base operated the pilot test blower system for another 3.5 years.

Based on positive results from the one-year bioventing pilot test, funding was provided by the Air Force Center for Environmental Excellence (AFCEE) to expand bioventing treatment of vadose zone soils at Site FT-03. An expanded bioventing system

consisting of one new 4-inch diameter HVW; six new MPs, a new blower system, and associated piping, controls, and electrical service was installed at the site. Three of the four existing permanent MPs installed during previous pilot testing efforts (MPB, MPC, MPD) will continue to be used to monitor system performance. The original pilot test vent well (VW-1) was incorporated into the full-scale system for air injection. The regenerative blower system that had been used for pilot-scale testing was shut down, dismantled and moved to a storage area on the base.

The new system was installed by Parsons ES and subcontractors during three mobilizations. The first mobilization occurred between February 25-27, 1997 for installation of the new HVW (VW-2) and new MPs at the site. The second mobilization occurred from April 21-30, 1997, during which the blower systems, the electrical systems, and most of the piping systems were installed. Inclement weather and poor site conditions delayed further work at the site until May 8, 1997 when the third mobilization was initiated. Utility trenches were completed, the piping system was pressure tested, and final site grading and cleanup was completed during the third mobilization. The system at Site FT-03 was installed as described in the Final-Interim Measures Work Plan, Expanded Bioventing System, SWMU 55 (IRP Site FT-03), Charleston Air Force Base, South Carolina (Parsons ES, 1997). There were no deviations from the work plan during system installation. Figure 1 (attached) shows the site layout with the locations of the bioventing system components. Additional record drawings showing the final design details of the system components are provided in the enclosed O&M Manual.

Summary of Initial Sampling Results

Five soil samples and five soil gas samples were collected by Parsons ES for laboratory analysis during expanded system installation and prior to system startup. The soil samples were collected from boreholes installed for the MPs. Additionally, five shallow exploratory soil borings (BH-96-1 through BH-96-5) were advanced around the site to further define the extent of soil contamination (Figure 1). Field screening showed that soil samples from exploratory borings BH-96-1, BH-96-2, and BH-96-5 had VOC headspace readings ranging from 13 to 192 parts per million by volume (ppmv), indicating that these soils were not significantly impacted by fuels. Soil samples collected from borings BH-96-3 and BH-96-4 had maximum headspace VOCs readings of >2,500 ppmv and 819 ppmv, respectively.

Soil samples were analyzed by Intertek Testing Services (formerly Inchcape Testing Services) of Richardson, Texas. Analyses included the following: volatile organic hydrocarbons (including benzene, toluene, ethylbenzene, and xylenes [BTEX] and chlorinated hydrocarbons) by Method SW-8260a; total petroleum hydrocarbons (TPH) by Method SW-8015 modified for diesel-range organic (DRO) extractables and gasoline range organic (GRO) purgeables as jet fuel; polynuclear aromatic hydrocarbons (PAHs) and semi-volatile organic compounds (SVOCs) by Method SW-8270; and metals by Method SW-6010 and SW-7060. The Method SW-8260a analysis was substituted for the combined SW-8020 and SW-8010 analyses, which were originally specified in the Interim Measures Work Plan report (Parsons ES, 1997). Method SW-8260a includes all

the analytes of concern that are detected by the combined methods SW-8020/SW-8010. Method SW-8260a also includes the Trimethylbenzene isomers.

The soil gas samples were analyzed by Air Toxics, Ltd. of Folsom, California for BTEX and total volatile hydrocarbons (TVH) by Method TO-3. Prior to the collection of laboratory soil gas samples, soil gas samples from existing and newly-installed MPs were analyzed in the field by Parsons ES for oxygen, carbon dioxide, and TVH using direct-reading instruments. The results of the field screening were used to select the samples submitted for laboratory analysis. Soil and soil gas sampling results are summarized in Tables 1 and 2 (attached), respectively, and sampling locations are shown on Figure 1.

Vapor-phase and residual hydrocarbons were detected in subsurface soils at the site. Soil gas laboratory analyses detected TVH concentrations up to 10,000 parts per million by volume (ppmv) and vapor-phase BTEX compounds also were detected. Residual soil hydrocarbons are found throughout the former burn pit area, and heavy fuel staining was apparent in the soils during installation of the new HVW. Soil contamination is generally distributed throughout the vadose zone, from the ground surface to the water table. The water table occurs at depths of approximately 4 to 5 feet bgs near the center of the site.

Based on soil sampling results, the soil TPH concentrations appear to be highest in the immediate vicinity of the former burn pit. The highest detected TPH concentration (combined DRO and GRO) was 5,890 milligrams per kilogram (mg/kg) at MPF, as shown in Table 1. Sample MPG-(2.5) had a combined TPH-DRO and TPH-GRO concentration of 2,523 mg/kg. BTEX compounds were detected in each of the five soil samples. SVOC compounds also were detected in four of the five soil samples. Baseline soil TPH concentrations detected during the previous pilot study initiated in 1992 ranged from 51 milligrams per kilogram (mg/kg) to 2,200 mg/kg on the north side of the burn pit (ES, 1993).

Soil laboratory analyses confirm previous soil gas survey results (Parsons ES, 1997) and indicate that soil hydrocarbon contamination has not migrated far from the source areas. Low oxygen and high TVH concentrations were measured in soil gas samples collected from the MPs on the south side of the site, indicating the presence of widespread vapor-phase contamination and anaerobic conditions. Baseline soil gas samples collected from MPs on the north side of the burn pit had significantly higher oxygen concentrations (see Tables 2 and 4). Although the north side of the burn pit had undergone 4.5 years of bioventing treatment prior to operating the expanded bioventing system, limited oxygen utilization, indicative of microbial biorespiration, was still occurring in these soils.

Initial Operation Parameters

The expanded bioventing system was started on May 20, 1997. The system pressures and air injection rate for each HVW was adjusted twice during the next three weeks to allow the system to reach equilibrium and assure optimum air distribution to the contaminated soils. On June 11, 1997, air was being injected into vent well VW-1 at a rate of approximately 12.9 cubic feet per minute (cfm) and air was being injected into well VW-2 at a rate of approximately 24.8 cfm at a blower pressure of 57.5 inches of

water. During this time, pressure responses measured at the MPs ranged from a maximum of 33 inches of water at MPG-(3.3), to a minimum of 1.36 inches of water at MPC-(3.2). The pressure relief valve was readjusted and the pressure was subsequently reduced to 50 inches of water. Air flows to the HVWs at this reduced pressure were 9.8 cfm (VW-1) and 18.5 cfm (VW-2). Subsequent measurements demonstrate that the system pressures and flow rates fluctuate over time, probably due to changes soil moisture and the water table elevation. Based on pressure response measurements, it appeared that most of the areas of contaminated soil designated for bioventing treatment were being influenced by the expanded system (Table 3).

Oxygen, carbon dioxide, and TVH soil gas concentrations also were measured at the MPs before and after system optimization to confirm that the entire soil volume designated for remediation is being oxygenated (greater than 10 percent oxygen) by the expanded bioventing system. The area of oxygen influence designated for remediation is shown on Figure 1. This general area was designated for remediation based on soil gas survey results from June 1996 (Parsons ES, 1997). Soil gas oxygen concentrations measured in May and June 1997 during the expanded system operation exceeded 10 percent in all but one of the MPs located within the area designated for remediation. Soil gas oxygen measurements indicated that shallow soils at MPE were not receiving sufficient oxygen (see Table 4). The lack of significant oxygen influence at MPE after several months of bioventing appears to be a localized anomaly. Point MPE is located 30 feet from the nearest VW-2; however other MPs located between 25 to 36 feet from the same HVW are receiving sufficient oxygen (e.g. MPH, MPJ, MW3-13; see Table 4). It is possible that some sort of buried obstruction is located between MPE and VW-2, which could minimize soil gas migration in this area. Table 4 summarizes the soil gas oxygen concentrations measured after one month of full-scale system operation.

Operation, Maintenance and Monitoring

This site has been funded for one year of system monitoring services under Option 1 of the AFCEE-sponsored Extended Bioventing Project. Option 1 involves O&M support for 1 year and system monitoring at the end of the year. The O&M support period began following system start-up and will continue until June 1998. In mid-June 1998, Parsons ES will request Charleston AFB to shut down the blower unit. The blower unit will remain off for one month to allow subsurface conditions to equilibrate. In mid-July 1998, Parsons ES will return to the site to perform additional respiration testing and soil gas sampling. The results of these monitoring activities will be used to develop recommendations for further action at this site. Results and recommendations will be provided to AFCEE and Charleston AFB in a brief letter report. If significant cleanup of contaminated soils has been achieved based on the monitoring results, Parsons ES will recommend that closure soil sampling (Option 2) be performed at the site.

Potential Vapor Migration

Ambient air monitoring was conducted during startup of the expanded system. Monitoring results indicate that operation of the expanded bioventing system does not produce any detectable emissions in the breathing zone above background levels. Very

low TVH readings (i.e. <20 ppmv) were initially measured at the ground surface at several locations around the edges of the plastic surface seal during system startup. However, these TVH concentrations quickly declined and are no longer detectable.

Migration of fuel vapors through subsurface soils also was monitored during system startup. These results show that system operation will not result in offsite hydrocarbon vapor migration. As shown on Table 4, soil gas TVH concentrations decreased at all but two MPs after a month of operation. Two MPs (MPC, MPE) showed slight to moderate increases in soil gas TVH concentrations as a result of air injection at the HVWs. However, these vapor-phase hydrocarbons will be biodegraded as they move through the soils. Potential vapor migration through the soils does not pose any significant site risks since this is a remote site that does not have on-site workers or buried utilities and structures that could collect fuel vapors.

If you have any questions or comments regarding the information contained in this letter or in the enclosed O&M Manual, please contact me at (919) 677-0080 or John Ratz at (303) 831-8100.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Grant Watkins

S. Grant Watkins, P.G.
Site Manager

Attachments: References, Figure 1, Tables 1-4

Enclosure: O&M Manual

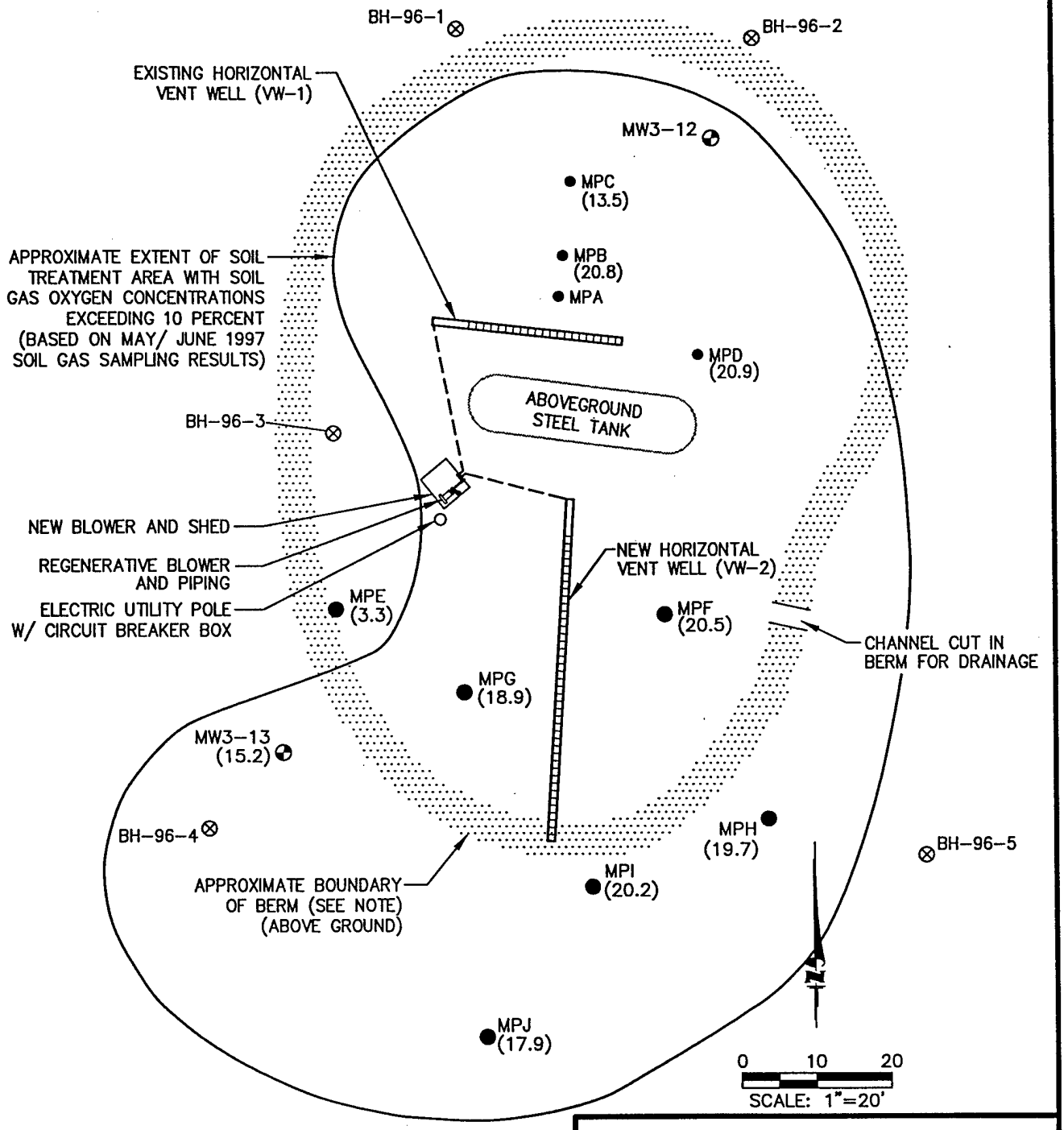
cc: Al Urrutia (Charleston AFB)
John Ratz (Project Manager, Parsons ES-Denver)
Don Malone (Parsons ES-Cary)
File 726876.28143

References

AFCEE, 1994. Memorandum for 437 SPTG/CEV regarding Completion of One-Year Bioventing Test, Fire Training Area, FT-03. 27 June.

Engineering-Science, Inc. 1993. *Part I-Bioventing Pilot Test Work Plan and Part II-Draft Interim Bioventing Pilot Test Results Report for Fire Protection Training Area Site FT-03, Charleston AFB, South Carolina.* January.

Parsons Engineering Science, Inc. 1997. *Final-Interim Measures Work Plan, Expanded Bioventing System, SWMU 55 (IRP Site FT-03), Charleston AFB, South Carolina.* April.



LEGEND

MW3-12	GROUNDWATER MONITORING WELL
MPF	SOIL VAPOR MONITORING POINT
(20.5)	SOIL GAS OXYGEN CONCENTRATION (%)
BH-96-5	SOIL BORING/ SAMPLING LOCATION
------	AIR INJECTION HEADER PIPE (BURIED)

NOTE:
SOIL BERM HAS APPROXIMATE ELLIPTICAL DIMENSIONS AND VARYING WIDTHS, LOCATIONS OF TANK, VENT WELL AND UTILITY POLE WITHIN BERM ARE ESTIMATED.

FIGURE 1

SITE PLAN AND BIOVENTING SYSTEM LAYOUT

Expanded Bioventing System
SWMU 55 (Site FT-03)
Charleston AFB, South Carolina

PARSONS ENGINEERING SCIENCE, INC.
Raleigh-Durham, North Carolina

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TABLE 1
SOIL ANALYTICAL RESULTS[a/]
SWMU 55 (SITE FT-03)
CHARLESTON AFB, SC

Analyte (Units)[b/]	Sample Location-(Depth) (feet below ground surface)				
Soil Hydrocarbons	**MPE-(3)**	**MPF-(2.5)**	**MPG-(2.5)**	**MPH-(1.5)**	**MPJ-(3)**
TPH/VOCs					
TPH-GRO as Jet Fuel (mg/kg)	106	1,670	513	0.4	0.38
TPH-DRO (mg/kg)	138	4,220	2,010	25.6	<10
Benzene (µg/kg)	17.5	<58.1[c/]	<557	26.9	7.65
Toluene (µg/kg)	21.1	<58.1	1,230	<5.77	<6.00
Ethylbenzene (µg/kg)	270	1,580	4,760	28.6	15.0
Xylenes (µg/kg)	358.7	2,160	17,560	63.2	56.1
1,3,5-Trimethylbenzene (µg/kg)	62.8	444	1,450	6.11	<6.00
1,2,4-Trimethylbenzene (µg/kg)	102	2,450	12,000	34.7	<6.00
PAHs/SVOCs					
Benzo(a)anthracene (mg/kg)	<0.366	<1.92	<0.368	1.20	<0.396
Benzo(b)flouranthene (mg/kg)	<0.366	<1.92	<0.368	1.58	<0.396
Benzo(k)flouranthene (mg/kg)	<0.366	<1.92	<0.368	0.550	<0.396
Benzo(a)pyrene (mg/kg)	<0.366	<1.92	<0.368	0.873	<0.396
Chrysene (mg/kg)	<0.366	<1.92	<0.368	1.19	<0.396
Fluoranthene (mg/kg)	<0.366	<1.92	<0.368	2.45	<0.396
Indeno(1,2,3-cd)pyrene (mg/kg)	<0.366	<1.92	<0.368	0.382	<0.396
2-Methylnaphthalene (mg/kg)	0.397	15.2	4.73	<0.381	<0.396
Naphthalene (mg/kg)	<0.366	9.58	4.19	<0.381	<0.396
Phenanthrene (mg/kg)	<0.366	<1.92	<0.368	1.06	<0.396
Pyrene (mg/kg)	<0.366	<1.92	<0.368	2.62	<0.396
Soil Metals					
Arsenic (mg/kg)	1.89	4.09	1.53	2.19	2.28
Barium (mg/kg)	16.8	16.9	18.3	23.3	18.4
Cadmium (mg/kg)	<0.55	<0.58	1.26	<0.58	<0.60
Chromium (mg/kg)	6.74	12.8	6.23	17.5	7.22
Lead (mg/kg)	15.1	51.5	30.5	<11.5	12.2

[a/]Soil samples collected February 25-26, 1997.
[b/](mg/kg) = milligrams per kilogram. (µg/kg) = micrograms per kilogram (Results reported on a dry weight basis)
[c/] Compound analyzed for, but was below quantitation detection limit. Number shown represents the quantitation limit.
TPH = Total Petroleum Hydrocarbons; GRO = gasoline range organics; DRO = diesel range organics
Note: Laboratory analysis for VOCs by Method SW-8260; for TPH by Methods 3550/5030 and SW-8015 (mod.); for polynuclear aromatic hydrocarbons (PAHs)/SVOCs by Method SW-8270; for metals by EPA Methods 6010A and 7060. Only those analytes that were detected in one or more soil samples are listed in table.

TABLE 2
INITIAL SOIL GAS FIELD AND LABORATORY ANALYTICAL RESULTS[a/]
SWMU 55 (SITE FT-03)
CHARLESTON AFB, SC

Sample Location	Screen Depth (feet)	Field Screening Data			Laboratory Analytical Data				
		Oxygen (%)	Carbon Dioxide (%)	TVH (ppmv) [b/]	TVH (ppmv)	Benzene (ppmv)	Toluene (ppmv)	Ethylbenzene (ppmv)	Xylenes (ppmv)
MPB	3.5	18.5	0.8	170	----	----[c/]	----	----	----
MPC	3.2	10.5	1.8	140	----	----	----	----	----
MPD	3.9	15.2	1.5	140	----	----	----	----	----
MPE	3.2	0.5	8.0	4,200	10,000	20M[d/]	120M	31	36
MPF	3.3	0.0	7.8	2,000	3,000	4	7.6	16	27M
MPG	3.3	2.0	7.0	5,600	9,600	25M	100M	37	90
MPH	2.8	3.4	6.5	8,200	8,200	47	14	9.5	22M
MPI	3.0	0.8	7.0	5,400	----	----	----	----	----
MPJ	3.0	2.2	7.5	4,800	6,300	24	14	3	5.2
MW3-13	5.8-7	0.0	4.3	8,000					

[a/] Soil gas field screening samples collected on 25 April 1997. Soil gas samples for laboratory analyses collected on 29 April 1997.

[b/] TVH = total volatile hydrocarbon results reported in parts per million, volume per volume. Field screening results exclude methane.

[c/] ---- = not analyzed.

[d/] M = reported value may be biased due to apparent matrix interferences.

TABLE 3
MAXIMUM PRESSURE RESPONSE AT SYSTEM VAPOR MONITORING POINTS

SWMU 55 (SITE FT-03)
CHARLESTON AFB, SC

AIR INJECTION PRESSURES AND FLOW RATES

VW-1: 12.9 cfm at a blower pressure of 57.5 in. H_2O

VW-2: 24.8 cfm at a blower pressure of 57.5 in. H_2O

Monitoring Location	Distance From Nearest VW (feet)	Screen Depth (feet bgs) [a/]	Maximum Pressure Response[b/] (inches of water)
MPB	10	3.5	2.42
MPC	20	3.2	1.36
MPD	10	3.9	5.40
MPE	30	3.2	18.5
MPF	12	3.3	28.5
MPG	12.5	3.3	33.0
MPH	29	2.8	21.0
MPI	12	3.0	28.0
MPJ	26.5	3.0	10.81
MW3-13	36	5.8-7	17.95

[a/] bgs = below ground surface.

[b/] Measurements taken on 11 June 1997 unless otherwise indicated. Note, soil gas pressures intended to represent long-term operating conditions. Readings fluctuated during the first month of system startup. Final blower operating pressure was reduced to 50 inches of water on 12 June 1997.

TABLE 4
AIR INJECTION INFLUENCE ON SOIL OXYGEN CONCENTRATIONS AT SYSTEM MONITORING POINTS

SWMU 55 (Site FT-03)
CHARLESTON AFB, SC

Monitoring Point Location	Distance From Nearest HVW (feet)	Screen Depth (feet bgs)[a/]	Initial Oxygen[b/] (%)	Final Oxygen[c/] (%)	Initial TVH[b/] (ppmv)	Final TVH[c/] (ppmv)
MPB	10.0	3.5	18.5	20.8	170	12
MPC	20.0	3.2	10.5	13.5[/d]	140	170
MPD	10.0	3.9	15.2	20.9	140	16
MPE	30.0	3.2	0.5	3.3[/d]	4,200	6,000
MPF	12.0	3.3	0.0	20.5	2,000	27
MPG	12.5	3.3	2.0	18.9	5,600	1,600
MPH	29.0	2.8	3.4	19.7	8,200	140
MPI	12.0	3.0	0.8	20.2	5,400	17
MPJ	26.5	3.0	2.2	17.9	4,800	84
MW3-13	36.0	5.8-7	0.0	15.2	8,000	3,000

[a/] bgs = below ground surface.

[b/] Measurements taken on 25 April 1997 for all MPs and MW3-13; MPF was remeasured on 28 April 1997 (data for this date shown in table). All readings collected prior to air injection.

[c/] Measurements taken on 11 June 1997 except as noted.

[d/] Value for MPC is reported as the maximum oxygen concentration observed after system startup, measured on 22 May 1997. The maximum oxygen concentration observed at MPE was 9.6% on 22 May 1997, but subsequent oxygen readings were lower at MPE (11 June 1997 data are shown). The screen on point MPC was submerged on 11 June 1997.

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SECTION 1

INTRODUCTION

This Operations and Maintenance (O&M) Manual has been created as a guide for monitoring and maintaining the performance of the expanded bioventing blower system and vent well plumbing at Solid Waste Management Unit (SWMU) 55 (Site FT-03, Former Fire Protection Training Area No. 3), Charleston AFB, South Carolina. Hereafter in this document, SWMU 55 will be referenced as Site FT-03 to be consistent with previous bioventing reports developed for this site. Record drawings of the expanded bioventing system installed at Site FT-03 are provided in Appendix A.

Bioventing is the forced injection of fresh air, or withdrawal of soil gas, to enhance the supply of oxygen in subsurface soils to promote *in situ* bioremediation of organic fuel compounds. A blower system is used to inject air into the soil, thereby supplying fresh atmospheric air (containing approximately 20.8 percent oxygen) to fuel-contaminated soils. Once oxygen is provided to the subsurface, existing soil bacteria aerobically metabolize the fuel residuals. Aerobic biodegradation is much more efficient than anaerobic biodegradation, which occurs in oxygen-depleted soils.

A pilot-scale bioventing system was installed and operated by Parsons Engineering Science, Inc. (Parsons ES; formerly Engineering-Science, Inc.) at the site from November 1992 through November 1993. The pilot-scale system consisted of one horizontal vent well (HVW) and four soil vapor monitoring points (MPs) installed on the north side of the former burn pit. Pilot test monitoring results showed that a large portion of the site was not being affected by the air injection, specifically areas on the south side of the burn pit.

Parsons ES installed a full-scale bioventing system to address the soil oxygen deficiency in areas with remaining soil contamination that were not treated by the pilot-scale system. The full-scale air injection bioventing system consists of a new air injection blower, a new HVW, six new soil gas MPs, and associated piping. The existing HVW and MPs used in the pilot-scale system were incorporated into the full-scale system. The new system was installed at the site from February, 1997 through May, 1997. The air injection rates of the full-scale bioventing system were optimized at each HVW to assure adequate aeration of contaminated soils to promote aerobic biodegradation. Soil gas monitoring performed in May and June 1997, after several weeks of operating both HVWs, indicates the majority of the area designated for bioventing treatment is receiving sufficient oxygen. Oxygen increases were observed at all soil gas MPs monitored at the site. Most of the subsurface soils in the treatment area are receiving oxygen concentrations greater 17%, although several locations have shown less significant increases in soil gas oxygen content.

Charleston AFB personnel are responsible for routine monitoring of the bioventing system. Parsons ES has trained Charleston AFB personnel on the maintenance requirements of this plan. If significant problems are encountered with the operation of the system, Parsons ES should be notified so repairs can be made. Under the Extended Bioventing Project Option 1, Parsons ES is responsible for system repair for a 1-year period after system startup. Parsons ES will retain responsibility for system repair until June 1998. Should the bioventing system cease to operate or develop a significant problem, please call the Parsons ES Site Manager, Mr. Grant Watkins, at (919) 677-0080, or Mr. John Ratz, at (303) 831-8100. If the system ceases to operate, first have a base electrician verify that adequate power is being supplied to the bioventing system blower motor prior to notifying Parsons ES.

SECTION 2

SYSTEM DESCRIPTION

2.1 BLOWER SYSTEM

A Gast® R4P115 blower, powered by a 1.5-horsepower direct drive motor, was installed at Site FT-03 on April 21-30, 1997. The blower was installed in a separate enclosure set on a concrete pad. The R4P115 blower is rated as having a maximum flow rate of 127 standard cubic feet per minute (scfm) at open flow and a maximum pressure rating of 65 inches of water. As installed, the single blower is manifolded to inject atmospheric air into vent well VW-1 on the north side of the burn pit, and into vent well VW-2 on the south side of the burn pit.

The expanded bioventing system was started on May 20, 1997. The system pressures and air injection rate for each HVW were adjusted twice during the next three weeks to allow the system to reach equilibrium and assure optimum air distribution to the contaminated soils. Final blower readings representative of longer term system performance were obtained on June 11-12, 1997. During the initial measurements taken on June 11, 1997, air was being injected into vent well VW-1 at a rate of approximately 12.9 actual cubic feet per minute (acfm) and into well VW-2 at a rate of approximately 24.8 acfm at a blower pressure of 57.5 inches of water. The pressure relief valve was readjusted and the blower pressure was subsequently reduced to 50 inches of water. The final adjusted air flows to the HVWs at this reduced pressure were 9.8 acfm (VW-1) and 18.5 acfm (VW-2) as measured on June 12, 1997. Flow was optimized to each HVW based on 1) the degree of hydrocarbon contamination present within soils in the vicinity of each HVW, 2) the amount of oxygen measured at surrounding MPs following three weeks of operation, and 3) limitations to air injection due to variations in site physical characteristics. Generally, higher air flow rates are being used at VW-2 since there is a significantly larger area of contaminated soil remaining on the south end of the site and vent well VW-2 has a longer screen interval than well VW-1.

The blower system includes an inlet air filter to remove any particulates which are entrained in the inlet air stream and several valves and monitoring gauges which are described in Section 2.2. A schematic of the expanded blower system installed at Site FT-03 is shown in Appendix A. Corresponding blower performance curves and relevant service information are provided in Appendix B. Blower system data collection sheets for use by base personnel are provided in Appendix C.

2.2 MONITORING AND FLOW CONTROL EQUIPMENT

2.2.1 Monitoring Gauges

The bioventing system is equipped with vacuum, pressure, and temperature gauges, and air velocity measurement ports. Gauges have been installed on the air injection system at the following locations: a vacuum gauge in the inlet piping and pressure and temperature gauges in the outlet piping of the blower.

2.2.2 Flow Control Equipment

Manual and automatic flow control valves (FCVs) have been installed on the bioventing blower system. Manual FCVs have been installed in the piping leading to each HVW to enable the air flow rate to each HVW to be adjusted individually. An automatic FCV, or pressure relief

valve (PRV), is used to protect the blower system from burning out if pressures rise due to pipe blockage. The automatic PRV is set to bleed off air flow at a preset pressure and thus prevent blower outlet pressure from ever achieving the maximum pressure rating of the blower (i.e. 65 inches of water). The automatic PRV has been set for pressure relief to begin at approximately 50 inches of water back pressure on the blower.

An additional manual FCV (air bleed valve) has been installed to control the total air flow out of the blower by releasing excess air flow to the atmosphere. The FCVs have been set by Parsons ES personnel to deliver a calculated amount of air to each HVW and should not be adjusted unless directed to do so by Parsons ES personnel.

The blower system also has been equipped with air flow measurement ports. These ports consist of brass bushings installed in the outlet piping leading to each HVW. These bushings, which should be plugged during system operation, allow the insertion of a thermal anemometer for the measurement of air velocity. These ports are used by Parsons ES for system optimization and should not be opened unless air flow measurements are being collected.

Although the blower system installed at Site FT-03 is relatively maintenance free, periodic system maintenance is required for proper operation and long life. Recommended maintenance procedures and schedule are described in detail in the instruction manuals included in Appendix B and briefly summarized in this section.

Filter inspection must be performed with the system turned off. Do not change the flow control valve settings (valves have been pre-set for a specific flow rate) before re-starting the blower.

SECTION 3

SYSTEM MAINTENANCE

3.1 BLOWER/MOTOR

The blower and its motor are relatively maintenance free and should not require any maintenance during the operational period. Both the blower and motor have sealed bearings and do not require lubrication.

3.2 AIR FILTER

To avoid damage caused by passing solids through the blower, an air filter has been installed in-line before the blower. The paper filter element is accompanied by a polyurethane foam pre-filter. The filter should be checked weekly for the first 2 months of operation. A facility employee should determine the best schedule for filter replacement based on the first 2 months of system monitoring. The polyurethane pre-filters can be washed with lukewarm water and a mild detergent. Paper filter elements should never be washed, and should be disposed of and replaced as necessary. When the vacuum drop across the filter increases by approximately 5 inches of water compared to the vacuum when the filter was new, a dirty filter element should be suspected. Cleaning or replacement of the filter should then be performed. The initial vacuum when the filter element was new was 4.5 inches of water as measured during final system optimization. Therefore, the filters should be cleaned or replaced when the vacuum increases to about 9.5 inches of water for the blower air intake. Typical filter element replacement intervals range from 3 to 6 months.

To remove the filter, turn the system off by pushing the electrical disconnect switch (on the adjacent electrical utility pole) to the "off" position. Then, loosen the three clamps or the wing nut on the filter top, lift the metal top off the air filter, and lift the air filter element from the metal housing. Remove the polyurethane pre-filter (if applicable) and wash before replacing.

The filter element is manufactured by Solberg Manufacturing, Inc. in Itasca, Illinois. Their toll free telephone number is 1-800-451-0642. Additional filters can also be obtained through Parsons ES. The Parsons ES contacts are Mr. Grant Watkins, at (919) 677-0080, and Mr. John Ratz, at (303) 831-8100. The part number for the replacement filter element is 30P. Four spare air filter elements have been placed inside each blower enclosure.

3.3 MAINTENANCE SCHEDULE

The following maintenance schedule is recommended for the blower system. During the initial few months of operation more frequent monitoring is recommended to ensure that any startup problems are quickly corrected. A daily drive-by inspection is recommended during the initial 2 weeks of operation to ensure that the blower system is still operating with no unusual sounds. Thereafter, monitoring inspections every 2 weeks are recommended (see Section 4). Preprinted data collection sheets have been provided to the facility. Extra data collection sheets for recording maintenance activities are provided in Appendix C.

Maintenance Item	Maintenance Frequency
Filter	Check once every 2 weeks, wash or replace as necessary (see Section 3.3). Inlet vacuum exceeding 9.5 inches of water indicates that the filter requires cleaning or replacement.

3.4 MAJOR REPAIRS

Regenerative blowers are very reliable when properly maintained. Occasionally, however, a motor or blower will develop a serious problem. If the blower system fails to start, and a qualified electrician verifies that power is available at the blower or starter, Parsons ES should be contacted to arrange for repairs. The Parsons ES contacts are Mr. Grant Watkins, at (919) 677-0080, and Mr. John Ratz, at (303) 831-8100. Parsons ES is responsible for major repairs during the first year of operation.

SECTION 4

SYSTEM MONITORING

4.1 BLOWER PERFORMANCE MONITORING

To monitor the blower's performance, the vacuum, pressure, and temperature will be measured. These data should be recorded every 2 weeks on a data collection sheet (provided in Appendix C). All measurements should be taken at the same time while the system is running. Because the system is noisy inside the enclosure, hearing protection should be worn at all times.

4.1.1 Vacuum/Pressure

With hearing protection in place, unlock and open the blower enclosure (the enclosure lid should be supported by the two metal pipes located inside each of the enclosures). Record all vacuum and pressure readings directly from the gauges (in inches of water) for the blower. Record the measurements on the data collection sheet.

4.1.2 Temperature

With hearing protection in place, open the blower enclosure and record the temperature reading directly from the gauge in degrees Fahrenheit (°F). Record the measurement on a data collection sheet (provided in Appendix C). The temperature change can be converted to degrees Celsius (°C) using the formula °C= (°F - 32) × 5/9. Temperatures of the operating blower system have varied from about 130-160 °F and will change slightly (decrease) once the enclosure lid is opened.

4.2 MONITORING SCHEDULE

The following monitoring schedule is recommended for the system. During the initial month of operation, more frequent monitoring is recommended to ensure that any start up problems are quickly corrected. Data collection sheets have been provided to assist your data collection and are included in Appendix C.

Monitoring Item	Monitoring Frequency
Vacuum/Pressure	Once every 2 weeks.
Temperature	Once every 2 weeks.

4.3 REPORTING MONITORING RESULTS

System monitoring data sheets should be faxed to the Parsons ES Site Manager, Mr. Grant Watkins (919) 677-0080, once every 2 months. However, if a significant change in the system temperature or pressures are noted (such as a significant drop or increase in pressure) please call Mr. Watkins immediately. A significant change in system temperature or pressure may be indicative of a problem with the air delivery system or blower.

APPENDIX A

RECORD DRAWINGS

RECORD DRAWINGS FOR

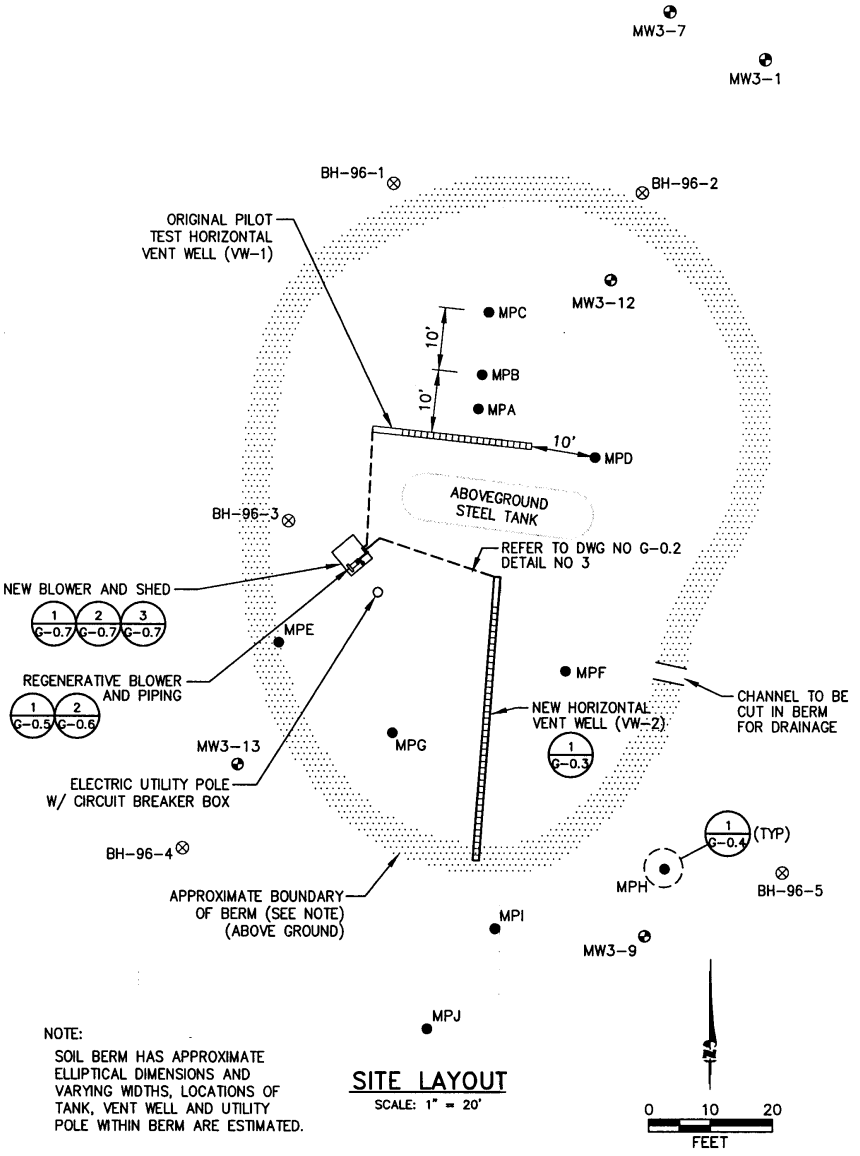
EXPANDED BIOVENTING SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AIR FORCE BASE

PREPARED FOR

AFCEE

JULY 1997

DRAWING INDEX



By	Description	Date	Rev
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	65% DESIGN	7/11/96	A

Job No. 726876.2B140
Designed RAF
Drawn MW
Checked
Reviewed
Approved
Reg No
Date

PARSONS ENGINEERING SCIENCE, INC
Denver, Colorado (303) 831-8100

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AIR FORCE BASE

TITLE SHEET AND SITE LAYOUT

DRAWING NO G-0.1 | REV B

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ABBREVIATIONS

AIJ	AIR INJECTION
APPROX	APPROXIMATE
ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS
&	AND
@	AT
CBM	CENTER BACK MOUNT
CLR	CLEAR
DIA	DIAMETER
DWG	DRAWING
EB	EXPLORATORY BORING
ECC	ECCENTRIC
EW	EACH WAY
FOT	FLAT ON TOP
FPT	FEMALE PIPE THREAD
FT	FOOT
GALV	GALVANIZED STEEL
HDPE	HIGH DENSITY POLYETHYLENE
ie	FOR EXAMPLE
LM	LOWER MOUNT
MAX	MAXIMUM
MIL	MILLIMETER
MIN	MINIMUM
MP	MONITORING POINT
MPT	MALE PIPE THREAD
NO, #	NUMBER
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
PW	PROPOSED WELL
RED	REDUCER
REF	REFERENCE
SCH	SCHEDULE
S	SOCKET
SPVC	SLOTTED POLYVINYL CHLORIDE
ST STL	STAINLESS STEEL
TYP	TYPICAL
UST	UNDERGROUND STORAGE TANK
VW	VENT WELL
W/	WITH
WN	WELD NECK
WWF	WELDED WIRE FABRIC

SYMBOLS

- MPC● — EXISTING BIOVENTING MONITORING POINT
- MPE○ — PROPOSED BIOVENTING MONITORING POINT
- BH-96-1⊗ — PROPOSED SOIL BORING
- 3-7⊕ — GROUNDWATER MONITORING WELL
- BERM
- – – – – PROPOSED HEADER PIPE TO VENT WELL

SECTION DESIGNATION (A / X) — SECTION NAME: **SECTION CUT** — SCALE: NTS — DRAWING OF ORIGIN — SCALE

DETAIL NO (1 / X) — DETAIL NAME: **DETAIL DESCRIPTION** — SCALE: NTS — DRAWING OF ORIGIN — SCALE

MATERIAL LEGEND

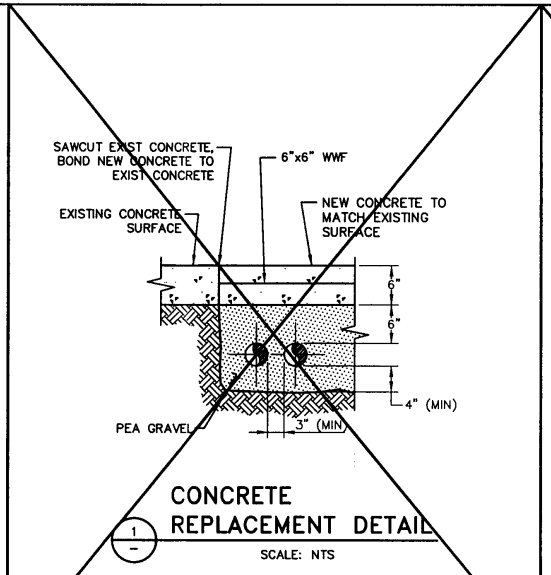
- ASPHALT
- BENTONITE
- BENTONITE/CEMENT GROUT
- BENTONITE PELLETS
- BUILDING (EXISTING)
- COMPACTED BACKFILL
- COMPACTED BASE STONE
- CONCRETE
- PEA GRAVEL
- SAND
- UNDISTURBED SOIL

PIPE MATERIAL

CS	CARBON STEEL
GALV	GALVANIZED STEEL
PVC	POLYVINYL CHLORIDE
SPVC	SCREENED POLYVINYL CHLORIDE

PIPE SERVICE

AIJ	AIR INJECTION
BIV	BIOVENTING
DR	DRAIN



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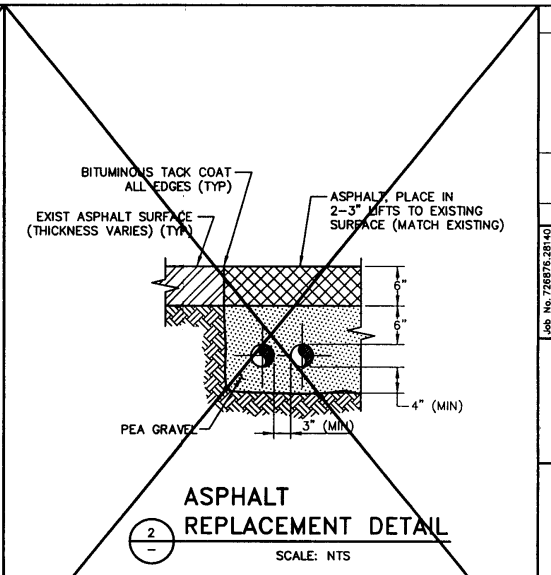

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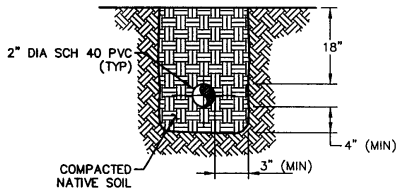
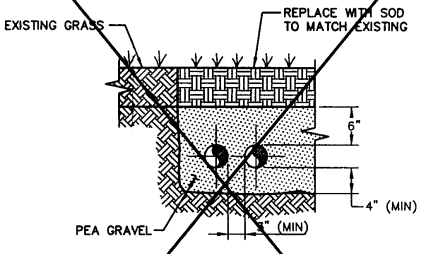


SOIL COVER REPLACEMENT DETAIL (3 / –) — SCALE: NTS



GRASS COVER REPLACEMENT DETAIL (4 / –) — SCALE: NTS

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B	7/16/97	RECORD DRAWINGS	

Job No. 726876.2814O
Designed RAF
Drawn MW
Checked
Reviewed
Approved
Req No.
Date

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Denver, Colorado (303) 831-8100

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AIR FORCE BASE

LEGEND AND STANDARD TRENCH DETAILS

DRAWING NO G-0.2 | REV B

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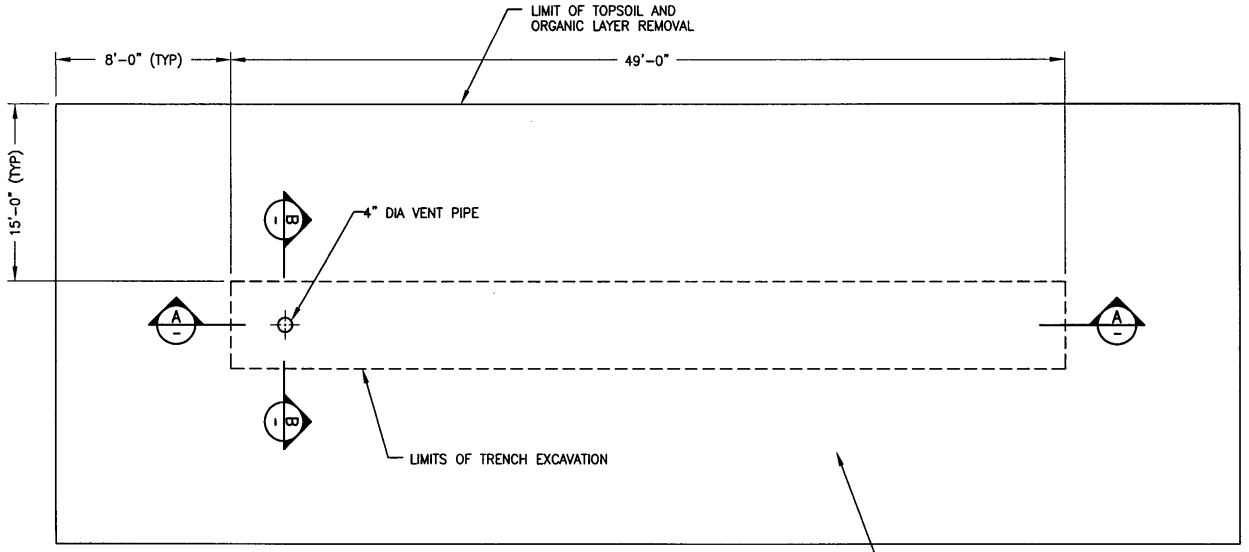
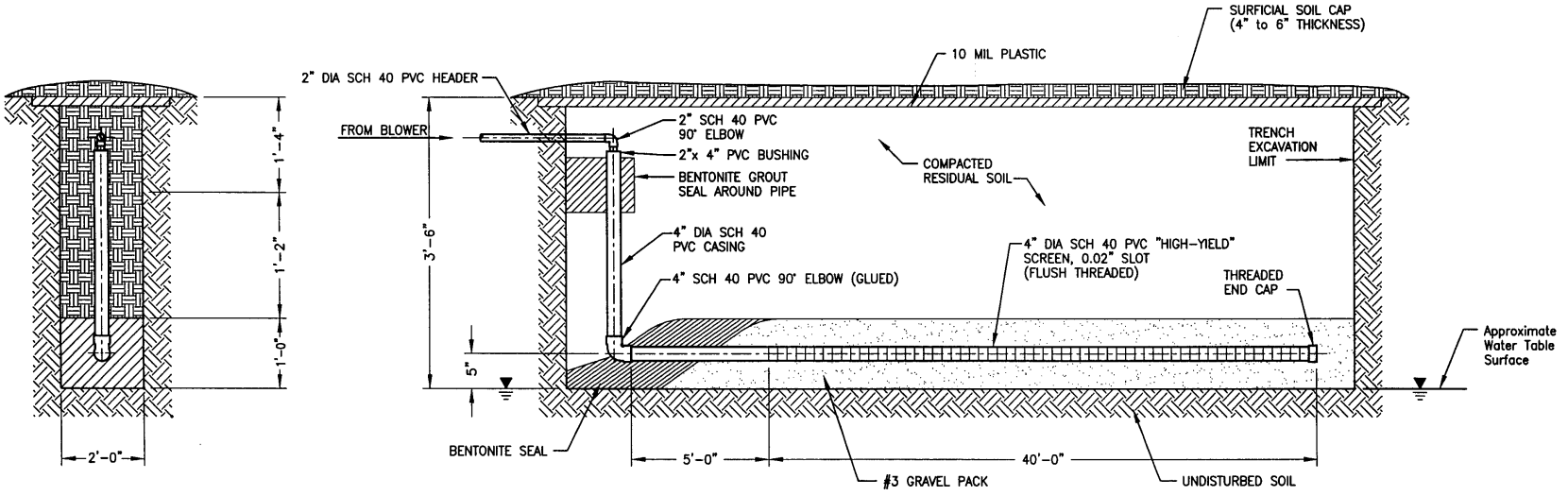
NOTES:

1. DRAWING IS NOT TO SCALE.
2. POLYETHYLENE SHEETING SHALL BE OVERLAPPED BY 5 FEET WHERE REQUIRED.



1 VENT WELL (VW) DETAIL



B SECTION

A SECTION

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Drawn	MW					
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Reviewed						
Approved		B	7/16/97	RECORD DRAWING		
Reg No		A	7/11/96	65% DESIGN		
Date		Rev	Date	Description		By

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AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
SIMAU 55 (SITE FT-03)
CHARLESTON AIR FORCE BASE

VENT WELL
STANDARD DETAIL

DRAWING NO G-0.3 | REV B

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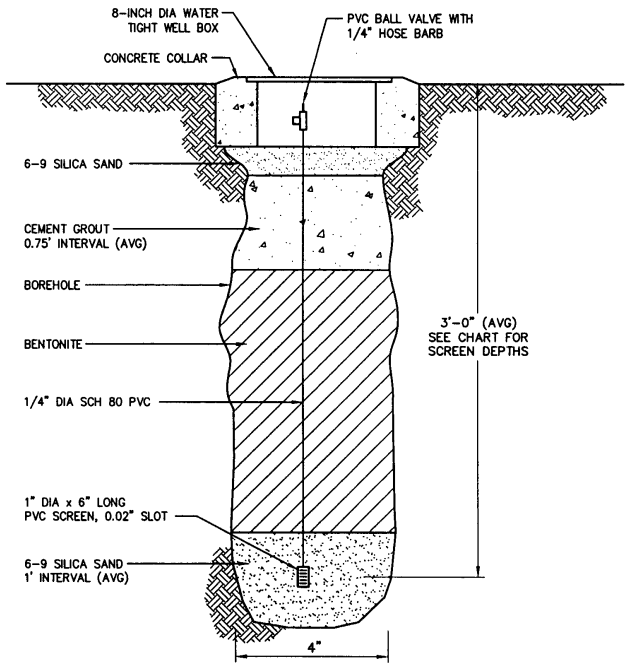

MONITORING POINT NO.	BOREHOLE DEPTH (ft. BGS)	SCREENED INTERVAL (ft. BGS)
MPE	3.25'	2.7' – 3.2'
MPF	3.3'	2.8' – 3.3'
MPG	3.5'	2.8' – 3.3'
MPH	3.2'	2.3' – 2.8'
MPI	3.2'	2.5' – 3.0'
MPJ	3.1'	2.5' – 3.0'

1/– MONITORING POINT (MP) DETAIL

SCALE: NTS

Job No. 726876.28140				
Designed RAF				
Drawn MW				
Checked				
Reviewed				
Approved	B	7/16/97	RECORD DRAWING	
Reg No	A	7/11/96	65% DESIGN	
Date	Rev	Date	Description	By

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AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AIR FORCE BASE

MONITORING POINT STANDARD DETAIL

DRAWING NO G-0.4

REV B

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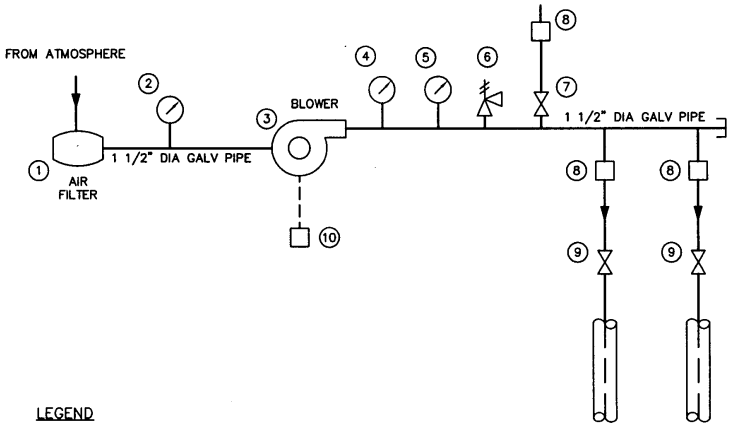

LEGEND

(1) INLET AIR FILTER – SOLBERG F-30P-150, REPLACEMENT ELEMENT 30P

(2) VACUUM GAUGE – GAST® AJ497, 2 5/8" DIA., 0–60" H_2O, 1/4" NPT, LM (Part No. AJ497)

(3) BLOWER – GAST® 1.5 HP R4P115N-50, 90 CFM AT 40" H_2O PRESSURE

(4) TEMPERATURE GAUGE – ASHCROFT, 0–250°F, 1/2" NPT, CBM (Part No. 2A606 FROM GRAINGER)

(5) PRESSURE GAUGE – WIKA 611.10, 2 1/2" DIA., 0–100" H_2O, 1/4" NPT, CBM (Part No. 9851879)

(6) AUTOMATIC PRESSURE RELIEF VALVE – GAST AG258, SET TO RELEASE AT 50" H_2O PRESSURE

(7) MANUAL PRESSURE RELIEF (BLEED) VALVE – 1 1/2" GATE

(8) FLOW MEASURING PORT FITTED WITH PLUG (1/4"x 1/8" NPT BRASS REDUCING BUSHING, 1/8" NPT BRASS PLUG)

(9) FLOW CONTROL VALVE – 1 1/2" GATE

(10) FUSED DISCONNECT SWITCH

1/– BLOWER PIPING AND INSTRUMENTATION DIAGRAM

SCALE: NTS

Job No. 726876.28140					
Designed	RAF				
Drawn	MW				
Checked					
Reviewed					
Approved		B	7/16/97	RECORD DRAWING	
Reg No		A	7/11/96	65% DESIGN	
Date		Rev	Date	Description	By

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AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AIR FORCE BASE

BLOWER P & ID

DRAWING NO: G-0.5
REV: B

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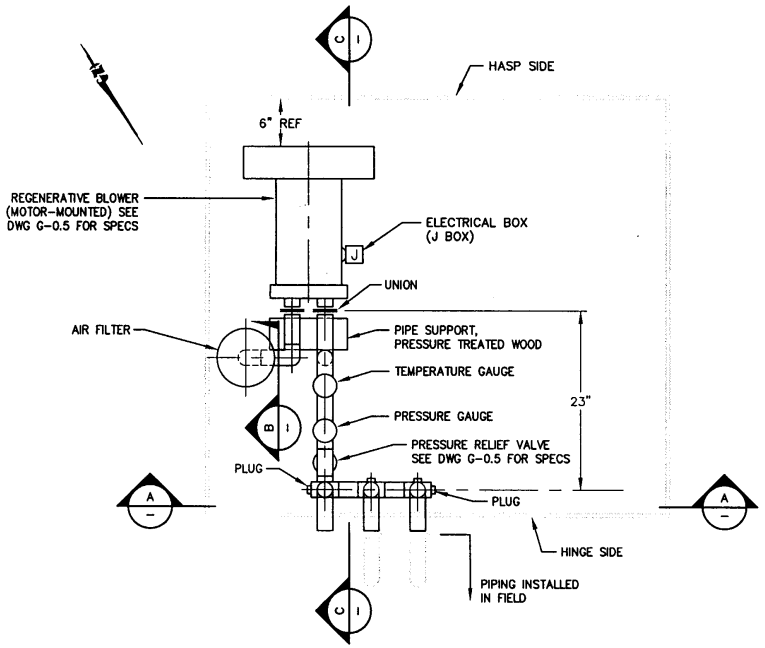
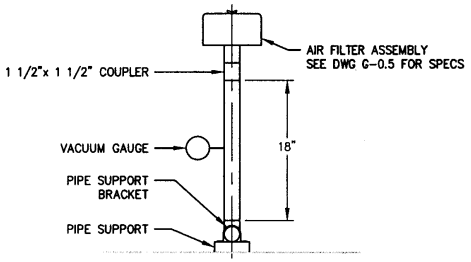


BLOWER PIPING LAYOUT PLAN DETAIL

3/4" = 1'-0"

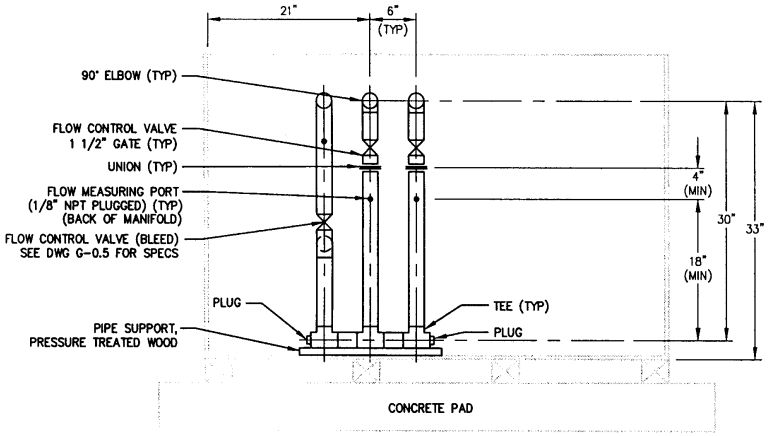
NOTES:

1. SHOP CORE HOLES TO PIPING DIMENSIONS
2. ALL PIPING 1 1/2" DIA. GALVANIZED STEEL, UNLESS OTHERWISE NOTED
3. SEE DRAWING G-0.7 FOR BLOWER BUILDING DETAILS



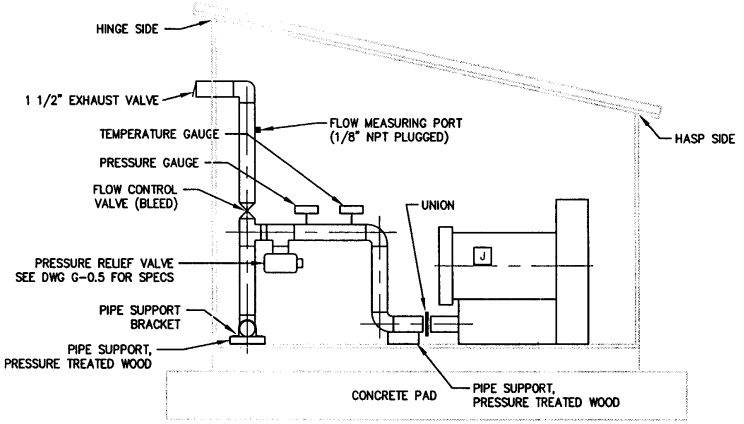
BLOWER INLET PIPING SECTION

3/4" = 1'-0"



MANIFOLD DETAIL SECTION

3/4" = 1'-0"



BLOWER OUTLET PIPING SECTION

3/4" = 1'-0"

Job No. 726876.28140						
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Drawn WW						
Checked						
Reviewed						
Approved	B	7/16/97	RECORD DRAWING			
Reg No	A	7/11/96	65% DESIGN			
Date	Rev	Date	Description	By		

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Denver, Colorado (303) 831-8100

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AIR FORCE BASE

BLOWER PIPING LAYOUT DETAIL

DRAWING NO G-0.6 | REV B

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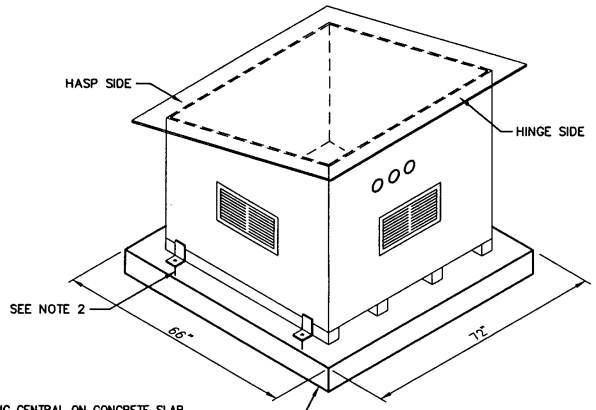
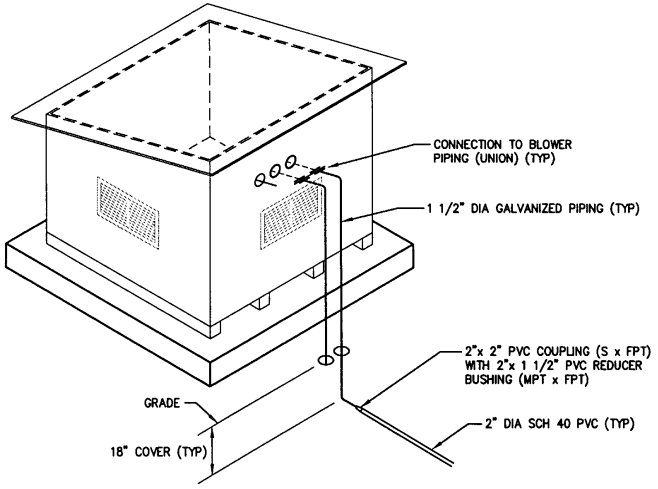


NOTES:

1. INSTALLED BUILDING CENTRAL ON CONCRETE SLAB WITH ORIENTATION AS SHOWN
2. FIELD SECURED BLOWER SHED TO CONCRETE SLAB AT LOCATIONS BY EXTERIOR ANGLE BRACKETS. BRACKET SECURED TO SHED WITH WOOD SCREWS AND TO CONCRETE SLAB WITH 4" ANCHOR BOLTS.

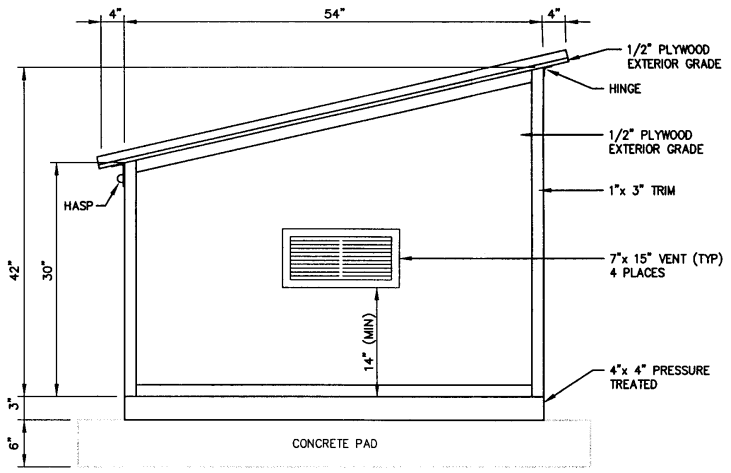
1/– BLOWER SHED FIELD INSTALLATION DETAIL

NOT TO SCALE

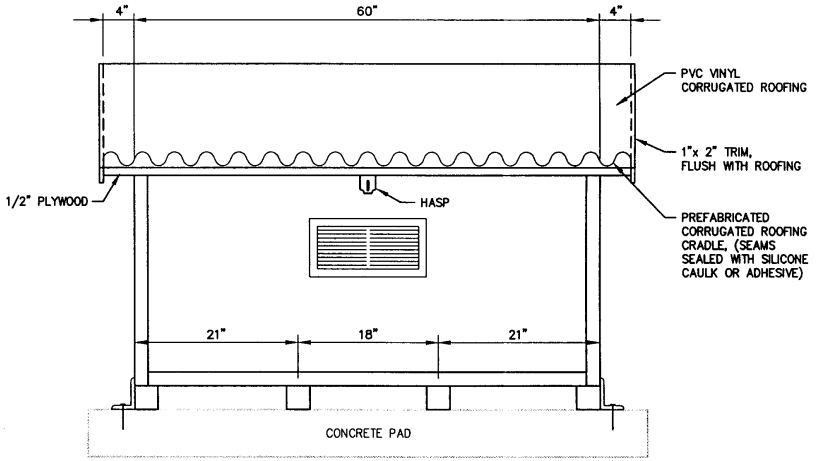


2/– TYPICAL MANIFOLD DISCHARGE PIPING LAYOUT

NOT TO SCALE



SIDE ELEVATION



FRONT ELEVATION

NOTES:

1. 2"x 2" FRAME CONSTRUCTION
2. FLOOR CONSTRUCTED OF 3/4" EXTERIOR GRADE PLYWOOD
3. ROOF CONSTRUCTED OF 1/2" EXTERIOR GRADE PLYWOOD COVERED WITH PVC VINYL CORRUGATED ROOFING

3/– BLOWER SHED CONSTRUCTION DETAIL

3/4" = 1'-0"

By	Description	Date	Rev
	RECORD DRAWING	7/16/97	B
	65% DESIGN	7/11/96	A

Job No. 726876.28140
Designed RAF
Drawn MW
Checked
Reviewed
Approved
Req No
Date

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado (303) 831-8100

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AIR FORCE BASE

BLOWER SHED FIELD INSTALLATION DETAIL AND BLOWER SHED CONSTRUCTION DETAILS

DRAWING NO G-0.7 | REV B

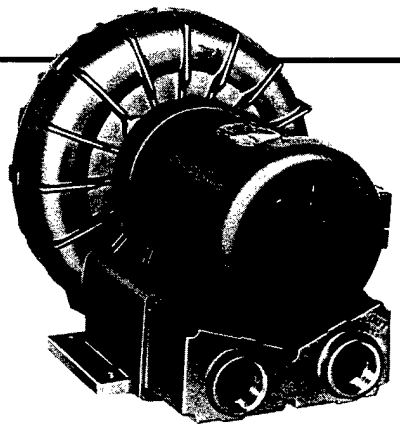
APPENDIX B

REGENERATIVE BLOWER INFORMATION

Oilless Regenerative Blowers, Motor Mounted to 127 cfm

GAST®

REGENAIR® R4P Series



MODEL R4P115
65″ H_2O MAX. PRESSURE, 127 CFM OPEN FLOW
60″ H_2O MAX. VACUUM, 125 CFM OPEN FLOW

MODEL R4P315A
63″ H_2O MAX. PRESSURE, 127 CFM OPEN FLOW
59″ H_2O MAX. VACUUM, 125 CFM OPEN FLOW

PRODUCT FEATURES

- Oilless operation
- TEFC motor mounted
- Can be mounted in any plane
- Rugged construction/low maintenance
- Class B insulation on motors
- Automatic restart thermal protection on single phase models

COMMON MOTOR OPTIONS

- 115/208-230V, 60 Hz; 110/220-240V, 50 Hz, single phase
- 208-230/460V, 60 Hz; 190-220/380-415V, 50 Hz, three phase

RECOMMENDED ACCESSORIES

- Pressure gauge AE133
- Filter AJ126D (pressure)
- Vacuum gauge AJ497
- In-line filter AJ151E (vacuum)
- Muffler AJ121D
- Relief valve AG258
- Nema motor starter size – 1/0 (R4P115), 00/00 (R4P315A), for 60 Hz operation
- Moisture separator RMS200 (vacuum)

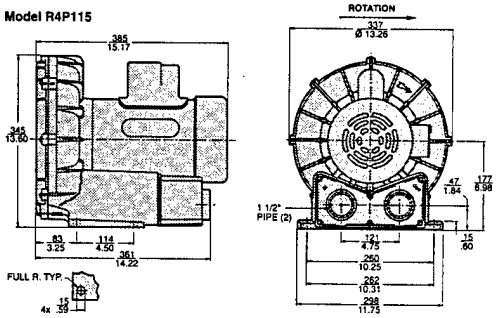
Various brand name motors are used on any model at the discretion of Gast Mfg. Corp.

Important Notice:

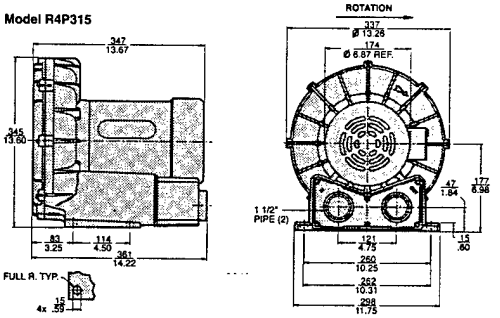
Pictorial, performance and dimensional data is subject to change without notice.

Product Dimensions Metric (mm) U.S. Imperial (inches)

Model R4P115



Model R4P315

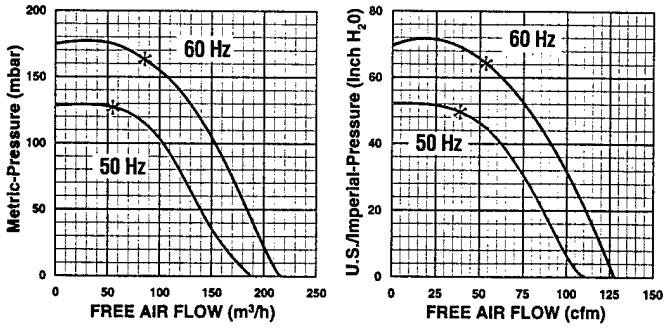


Product Specifications

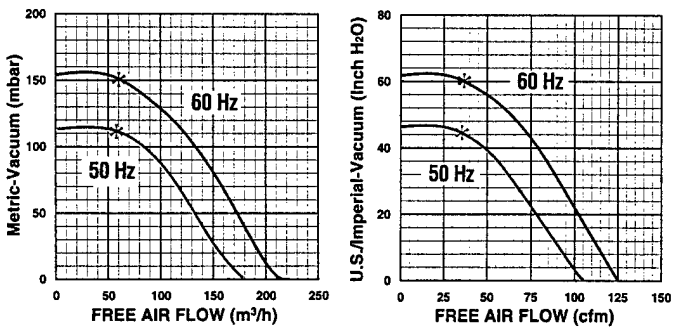
Model Number	Motor Specs	Full Load Amps	Locked Rotor Amps	HP	RPM	Max Vac		Max Pressure		Max Flow		Net Wt.	
						″H_2O	mbar	″H_2O	mbar	cfm	m^3h	lbs.	kg
R4P115	110/220-240-50-1	16.0/8.0-9.3	49.0 @ 230V	1.0	2850	45	112	50	125	110	187	61	27,7
	115/208-230-60-1	20.7/11.2-10.4		1.5	3450	60	149	65	162	127	216		
R4P315A	190-220/380-415-50-3	3.9-4.3/1.9-2.0	18.5 @ 460V	1.0	2850	43	107	47	117	110	187	43	24,1
	208-230/460-60-3	5.1-4.9/2.5		1.5	3450	59	147	63	157	127	216		

Product Performance (Metric U.S. Imperial)

Pressure



Vacuum



***Recommended maximum duty.**

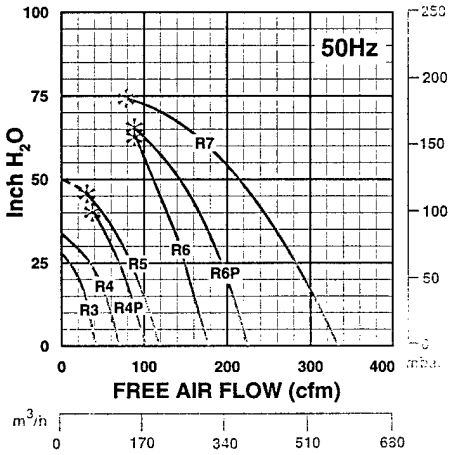
SOIL VAPOR EXTRACTION PUMPS – REGENERATIVE BLOWERS

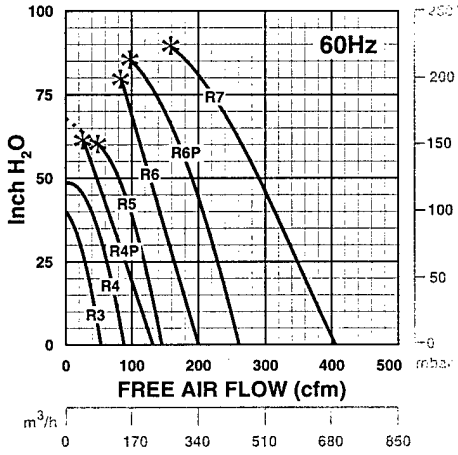
Product Specifications

Model Number	Motor Specifications					Max Vac		Max Pressure		Max Flow		Net. Wt.	
	Phase	Hz	Voltages	HP	Full Load Amps	"H_2O	mbar	"H_2O	mbar	cfm	m^3h	lbs	kg
R3105N-50	Single	50	110/220-240	.33	3-8/1.9-2.0	28	70	31	77	43	73	52	24
		60	115/208-230	0.5	5.2/2.9-2.6	40	100	43	107	53	90		
R4110N-50	Single	50	110/220-240	0.6	9.2/5.2-4.6	35	87	38	95	74	126	60	28
		60	115/208-230	1.0	11.4/6.2-5.6	48	120	51	127	92	156		
R4310P-50	Three	50	220/380	0.6	3.2/1.6	35	87	38	95	74	126	58	27
		60	208-230/460	1.0	3.4-3.3/1.65	48	120	51	127	92	156		
R4P115N-50	Single	50	110/220-240	1.0	15.2/7.6-8	40	100	45	112	112	190	79	36
		60	115/208-230	1.5	18.2/9.7-9.1	60	149	65	162	133	226		
R5125Q-50	Single	60	115/230	2.0	25/12.5	60	149	55	137	160	272	77	35
R5325R-50	Three	50	190-220/380-415	1.5	5.0-4.4/2.5-2.6	47	117	50	125	133	226	75	34
		60	208-230/460	2.0	6.0-5.6/2.8	60	149	65	162	160	272		
R6130Q-50	Single	50	220-240	2.5	14.7-13.5	65	162	75	187	182	309	129	59
		60	230	3.0	16.3	70	174	60	149	215	365		
R6340R-50	Three	50	190-220/380-415	3.0	14.4-13.4/7.2-6.8	65	162	75	187	180	306	112	51
		60	208-230/460	4.0	13-12/6	80	199	100	249	215	365		
R6P155Q-50	Single	50	220-240	4.0	20.8-19.1	65	162	80	199	235	399	243	110
		60	230	5.5	29.9	85	212	95	237	280	476		
R6P355R-50	Three	50	190-220/380-415	4.5	14.9-11/7.45-5.8	65	162	80	199	232	394	233	105
		60	208-230/460	6.0	20-18/9	85	212	100	249	280	476		
R7100R-50	Three	50	190-220/380-415	8.0	20.8-18.9/10.4-9.5	72	179	80	199	350	595	297	134
		60	208-230/460	10.0	26.5-24/12	90	224	90	224	420	714		

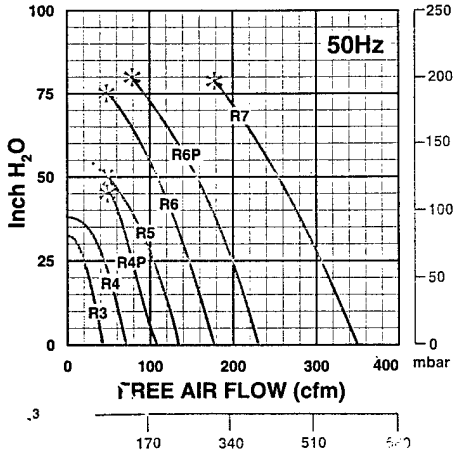
NOTICE: Performance specifications subject to change without notice.

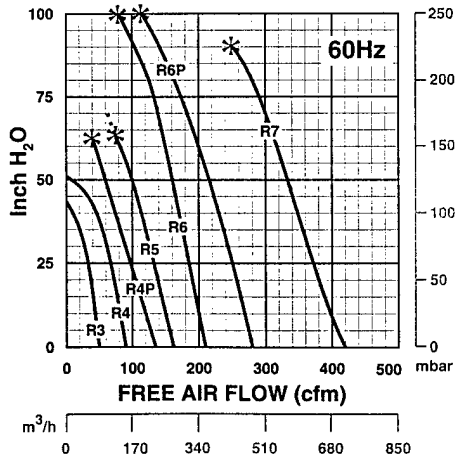
VACUUM





PRESSURE



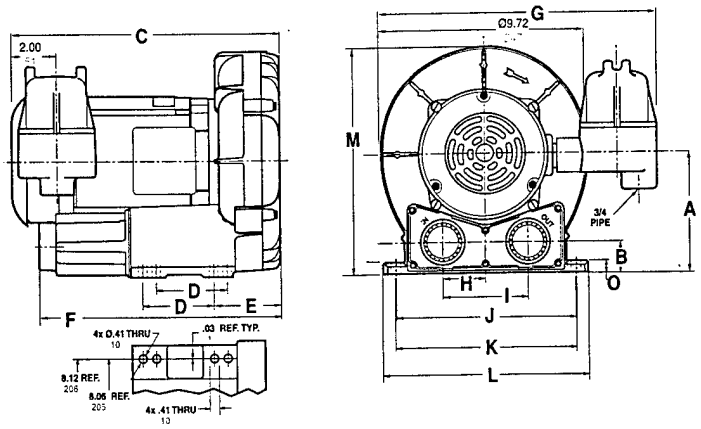


Free software identifies best Gast blowers for soil and groundwater remediation

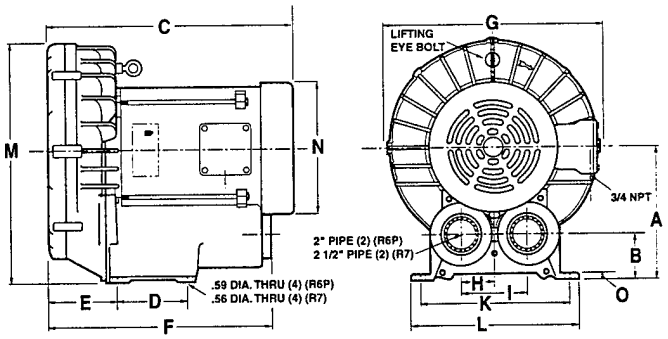
Now you can size and select regenerative blowers and accessories for soil and groundwater remediation systems faster, easier and more accurately than ever before. Gast remediation system engineering software does the job and it is yours for the asking. The 3-½-inch IBM-compatible disk calculates performance when the blower is operating with both a vacuum and pressure load at the same time. The programs will also compensate for changes in performance from altitude and temperature, helping you identify the optimum Gast blowers for your application.

Call 1-800-952-4278 to receive your free remediation system engineering software.

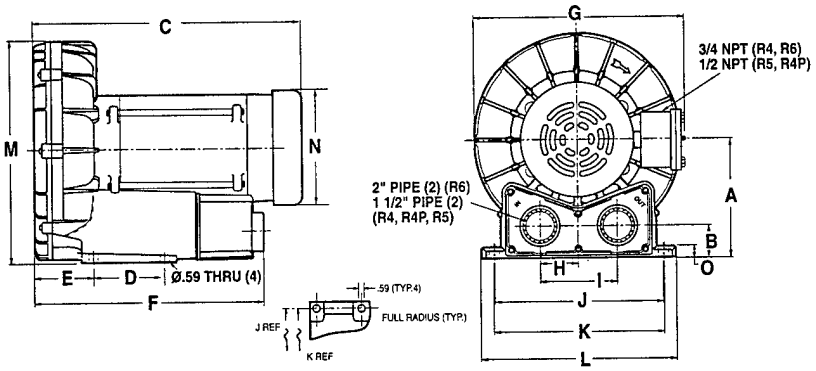
Model R3



Models R6P, R7



Models R4, R4P, R5, R6



Product Dimensions Metric (mm) U.S. Imperial (inches)

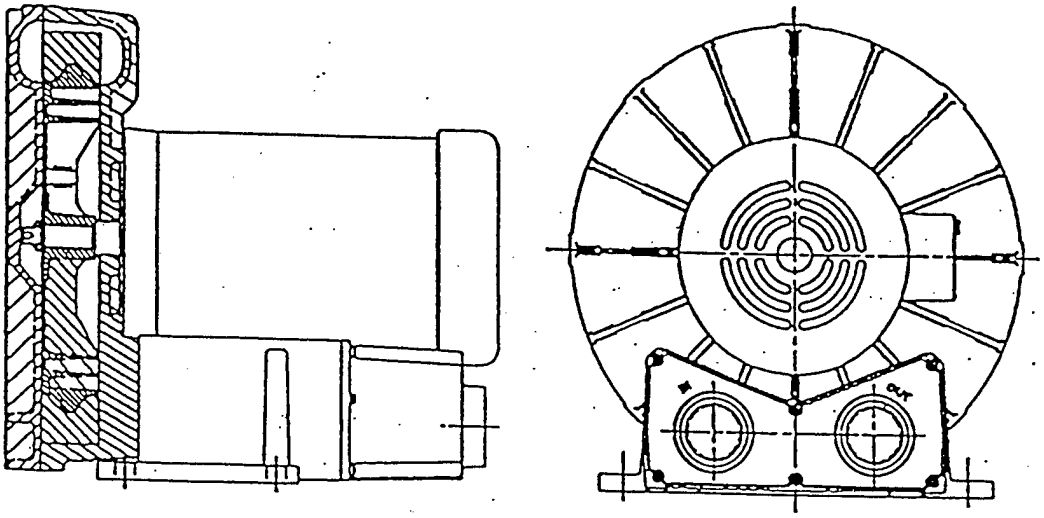
Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
R3105N-50	131	35		83	80	281	324	49	99	205	206	238	258	-	13
	5.17	1.37	12.20	3.25	3.03	11.06	12.75	1.94	3.88	8.06	8.12	9.38	10.15	-	.53
R4110N-50	157	43		96	72	316	313	50	101	225	227	254	293	175	11
	6.18	1.68	15.30	3.75	2.85	12.44	12.31	1.98	3.96	8.86	8.93	10.00	11.73	6.88	.44
R4310P-50	157	43	356	95	72	316	313	50	101	225	227	254	293	175	11
	6.18	1.68	14.03	3.75	2.84	12.44	12.31	1.98	3.96	8.86	8.93	10.00	11.73	6.88	.44
R4P115N-50	177	47	442	114	83	354	338	60	121	260	262	298	346	175	15
	6.98	1.84	17.41	4.50	3.25	13.93	13.31	2.38	4.75	10.25	10.31	11.75	13.6	6.88	.60
R5125Q-50	178	46	445	114	91	361	344	60	121	260	262	298	350	173	15
	7.00	1.82	17.50	4.50	3.58	14.22	13.56	2.38	4.75	10.25	10.31	11.75	13.78	6.81	.59
R5325R-50	178	46	423	114	91	361	344	60	121	260	262	298	350	183	15
	7.00	1.82	16.66	4.50	3.58	14.22	13.56	2.38	4.75	10.25	10.31	11.75	13.78	7.19	.59
R6130Q-50	197	49	511	140	98	404	389	62	125	289	290	329	391	217	13
	7.75	1.94	20.13	5.50	3.85	15.89	15.30	2.46	4.92	11.38	11.42	12.96	15.38	8.56	.52
R6340R-50	197	49	478	140	98	404	385	62	125	289	290	329	390	217	13
	7.75	1.94	18.82	5.50	3.85	15.89	15.17	2.46	4.92	11.38	11.42	12.96	15.34	8.56	.52
R6P155Q-50	248	80	602	140	137	438	428	64	127	-	290	325	463	257	13
	9.77	3.15	23.7	5.51	5.39	17.25	16.87	2.50	5.00	-	11.42	12.80	18.21	10.12	.50
R6P355R-50	248	80	554	140	137	438	428	64	127	-	290	325	463	257	13
	9.77	3.15	21.80	5.51	5.39	17.25	16.87	2.50	5.00	-	11.42	12.80	18.21	10.12	.50
R7100R-50	274	92	577	216	212	545	457	100	200	-	375	410	509	257	14
	10.79	3.64	22.72	8.50	8.33	21.46	18.00	3.94	7.88	-	14.76	16.14	20.02	10.12	.56

Notice: Specifications subject to change without notice.

GAST

Post Office Box 97
Benton Harbor, Michigan 49023-0097
Ph: 616/926-6171
Fax: 616/925-8288

Maintenance Instructions for Gast Standard Regenerative Blowers



For original equipment manufacturers
special models, consult your local distributor

Gast Rebuilding Centers

Gast Mfg. Corp.
2550 Meadowbrook Rd.
Benton Harbor MI. 49022
Ph: 616/926-6171
Fax: 616/925-8288

Gast Mfg Corp.
505 Washington Avenue
Carlstadt, N. J. 07072
Ph: 201/933-8484
Fax: 201/933-5545

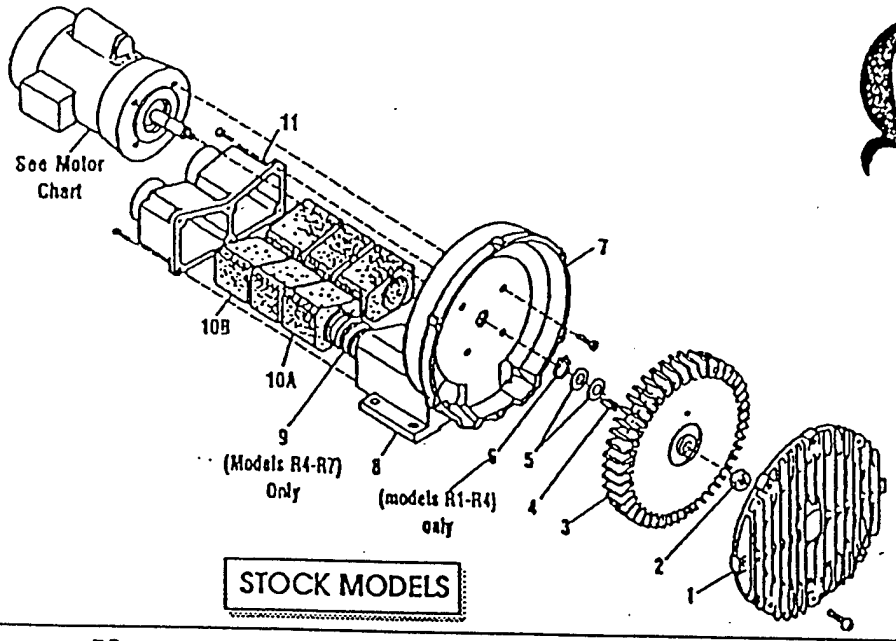
Brenner Fiedler. & Assoc.
13824 Bentley Place
Cerritos, CA. 90701
Ph: 213/404-2721
Fax: 213/404-7975

Wainbee, Limited
121 City View Drive
Toronto, Ont. Canada M9W 5A9
Ph: 416/243-1900
Fax: 416/243-2336

Wainbee, Limited
215 Brunswick Drive
Pointe Claire, P.Q. Canada H9R 4R7
Ph: 514/697-8810
Fax: 514/697-3070

Gast Mfg. Co. Limited.
Halifax Rd, Cressex Estate
High Wycombe, Bucks HP12 3SN
Ph. 44 494 523571
Fax: 44 494 436588

Japan Machinery Co. Ltd.
Central PO Box 1451
Tokyo 100-91 Japan
Ph: 813/3573-5421
Fax: 813/3571-7865



STOCK MODELS

Part Name	R1	R2	R3	R4	R5	R6	R6P	R6PP/R6PS	R7
#1 Cover	AJ101A	AJ101B	AJ101C	AJ101D	AJ101EQ	AJ101F	AJ101K	(2)AJ101KA	AJ101G
#2 Stopnut	BC187	BC187	BC181	BC181	BC181	BC181	BC181	(2)BC182	BC183
#3 Impeller	AJ102A	AJ102BQ	AJ102C	AJ102D	AJ102E	AJ102FR	AJ102K	(2)AJ102KA	AJ102GA
#4 Square Key	AH212C	AH212	AB136A	AB136D	AB136	AB136	AB136	(2)AB136	AC628
#5 Shim Spacer (s)	AJ132	AE686-3	AJ109	AJ109	AJ109	AJ116A	AJ116A	AJ116A	AJ110
#6 Retaining Ring	AJ145	AJ145	AJ149	AJ149					
#7 Housing	AJ103A	AJ103BQ	AJ103C	AJ103DR	AJ103E	AJ103F	AJ103K	AJ103KD	AJ103GA
#8 Muffler Box					AJ104E	AJ104F			
#9 Spring				AJ113DR	AJ113DQ	AJ113FQ	AJ113FQ		AJ113G
#10A Foam	(4)AJ112A	(4)AJ112B	(4)AJ112C	(4)AJ112DS	(4)AJ112ER	(6)AJ112F	(8)AJ112K		(8)AJ112GA
#10B Foam		(2)AJ112BQ	(2)AJ112CQ	(2)AJ112DR	(2)AJ112EQ				
#11 Muffler Extension/ Adapter Plate	AJ106H	AJ106BQ	AJ106CQ	AJ106DQ	AJ106EQ	AJ106FQ	AJ104K		AJ104GA
Shim Kit	K396	K396							K395

MOTOR CHART

REGENAIR MODEL NUMBER	MOTOR NUMBER	MOTOR SPECIFICATIONS 60 HZ VOLTS	50 HZ VOLTS	PHASE
R1102	J111X	115/208-230	110/220-240	1
R1102C	J112X	115		1
R2103	J311X	115/208-230	110/220	1
R2105	J411X	115/208-230	110/220	1
R2303A	J310	208-230/460	220/380-415	3
R2303F	J313	208-230	220	3
R3105-1/R3105-12	J411X	115/208-230	110/220-240	1
R3305A-1/R3305A-13	J410	208-230/460	220/380-415	3
R4110-2	J611AX	115/208-230	110/220-240	1
R4310A-2	J610	208-230/460	220/380-415	3
R5125-2	J811X	115/208-230		1
R5325A-2	J810X	208-230/460	220/380-415	3
R6125-2	J811X	115/208-230		1
R6325A-2	J810X	208-230/460	220/380-415	3
R6335A-2	J910X	208-230/460	220/380-415	3
R6150J-2	J1013	230		1
R6350A-2	J1010	208-230/460	220/380-415	3
R6P335A	J910X	208-230/460	220/380-415	3
R6P350A	J1010	208-230/460	220/380-415	3
R6P355A	J1110A	208-230/460	220/380-415	3
R7100A-2*	J1210B	208-230/460	220/380-415	3
R6PP/R6PS3110M	JD1100	208-230/460	220/380-415	3

* No lubrication needed at start up. Bearings lubricated at factory.

* Motor is equipped with alemite fitting. Clean tip of fitting and apply grease gun. Use 1 to 2 strokes of high quality ball bearing grease.

Consistency	*Type*	*Typical Grease*
Medium	Lithium	Shell Dolium R

Hours of service per year	*Suggested Relube Interval*
5,000	3 years
Continual Normal Application	1 year
Seasonal service motor idle for 6 months or more	1 year beginning of season 6 months
Continuous-high ambients, dirty or moist applications.	

All performance figures relate to stock models. A few high pressure units may be available. Consult your local distributor.

Regenair Model Number	PRESSURE 0"H_2O	20"H_2O	40"H_2O	60"H_2O	80"H_2O	100"H_2O	Maximum Pressure "H_2O*
R1	26	14					28
R2	42	26					38
R3105-1	52	38	14				42
R3105-12	52	36	23				55
R3305A-13	52	36	23				55
R4	90	70	50				52
R5	145	130	100				65
R6125-2	200	180					35
R6325A-2	200	180	152				40
R6335A-2	205	175	155	135			70
R6350A-2	200	180	150	130	110	80	105
R6P335A	290	250					30
R6P350A	300	260	230	200			60
R6P355A	300	260	230	200	160		90
R7100A-2	420	380	340	310	280	230	115
R6PP311OM	485	452	420	380	330		95
R6PS311OM	265	258	252	244	236	226	170

Regenair Model Number	VACUUM 0"H_2O	20"H_2O	40"H_2O	60"H_2O	80"H_2O	Maximum Vacuum "H_2O*
R1	25	14				26
R2	40	22				34
R3105-1	50	34	9			40
R3105-12	51	34	20			50
R3305A-13	51	34	20			50
R4	82	62	39			48
R5	140	115	90	50		60
R6125-2	190	155	125			45
R6325A-2	190	155	125			45
R6335A-2	190	150	125	100		75
R6350A-2	190	180	150	100	70	90
R6P335A	270	230				37
R6P350A	280	240	210	170		70
R6P355A	280	240	210	170	100	86
R7100A-2	410	350	300	250	170	90
R6PP311OM	470	425	375	320	220	80
R6PS311OM	240	225	210	195	175	130

*This number indicates the maximum static pressure differential recommended (with cooling air still flowing through unit). In general, units 1hp or less can be dead headed. Check with local representative or distributor to verify which models apply.

Operation of the blower above the recommended maximum duty will cause premature failure due to the build up of heat damaging the components.

Performance data was determined under the following conditions:

1) Unit in a temperature stable condition.
2) Test conditions: Inlet air density at 0.075lbs. per cubic foot. (20°C(68°F), 29.92 in. Hg(14.7PSIA)).
3) Normal performance variations on the resistance curve within +/- 10% of supplied data can be expected.
4) Specifications subject to change without notice.
5) All performance at 60Hz operation.

Post Office Box 97
Benton Harbor, MI. 49023-0097
Ph: 616/926-6171
Fax: 616/925-8288

70-6100.X
F2-205/8/92
Rev. E 4-96

INSTALLATION AND OPERATING INSTRUCTIONS FOR GAST HAZARDOUS DUTY REGENAIR BLOWERS

This instruction applies to the following models ONLY: R3105N-50, R4110N-50, R4310P-50, R4P115N-50, R5125Q-50, R5325R-50, R6130Q-50, R6P155Q-50, R6350R-50, R6P355R-50 and R7100R-50.

Gast Authorized Service Facilities are Located in the locations listed below

Gast Manufacturing Corporation
505 Washington Avenue
Carlstadt, N. J. 07072
Ph: 201/933-8484
Fax: 201/933-5545

Gast Manufacturing Corporation
2550 Meadowbrook Road
Benton Harbor, MI. 49022
Ph: 616/926-6171
Fax: 616/925-8288

Brenner Fiedler & Associates
13824 Bentley Place
Cerritos, CA. 90701
Ph: 310/404-2721
Ph: 800/843-5558
Fax: 310/404-7975

Wainbee Limited
215 Brunswick Blvd.
Pointe Claire, Quebec
Canada H9R 4R7
Ph: 514/697-8810
Fax: 514/-697-3070

Wainbee Limited
5789 Coopers Ave.
Mississauga, Ontario
Canada L4Z 3S6
Ph: 416/243-1900
Fax: 416/243-2336

Japan Machinery
Central PO Box 1451
Toyko 100-91, Japan
Ph: 813 3573-5421
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Halifax Road, Cressex Estate
High Wycombe, Bucks HP12 3SN
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Ph: 44 494 523571
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OPERATING AND MAINTENANCE INSTRUCTIONS

SAFETY

This is the safety alert symbol. When you see this symbol personal injury is possible. The degree of injury is shown by the following signal words:

⚠ DANGER Severe injury or death will occur if hazard is ignored.

⚠ WARNING Severe injury or death can occur if hazard is ignored.

⚠ CAUTION Minor injury or property damage can occur if hazard is ignored.

Review the following information carefully before operating.

GENERAL INFORMATION

This instruction applies to the following models ONLY: R3105N-50, R4110N-50, R4310P-50, R4P115N-50, R5125Q-50, R5325R-50, R6130Q-50, R6P155Q-50, R6350R-50, R6P355R-50 and R7100R-50. These blowers are intended for use in Soil Vapor Extraction Systems. The blowers are sealed at the factory for very low leakage. They are powered with a U.L. listed electric motor Class 1 Div. 1 Group D motors for Hazardous Duty locations. Ambient temperature for normal full load operation should not exceed 40° C (105° F). For higher ambient operation, contact the factory.

Gast Manufacturing Corporation may offer general application guidance: however, suitability of the particular blower and/or accessories is ultimately the responsibility of the user, not the manufacturer of the blower.

INSTALLATION

⚠ *DANGER Models R5325R-50, R6130Q-50, R6350R-50, R5125Q-50, R6P155Q-50, R6P355R-50 AND R7100R-50 use Pilot Duty Thermal Overload Protection. Connecting this protection to the proper control circuitry is mandated by UL674 and NEC501. Failure to do so could/may result in a EXPLOSION. See pages 3 and 4 for recommended wiring schematic for these models.*

⚠ *WARNING Electric shock can result from bad wiring. A qualified person must install all wiring, conforming to all required safety codes. Grounding is necessary.*

⚠ *WARNING This blower is intended for use on soil vapor extraction equipment. Any other use must be approved in writing by Gast Manufacturing. Corp.* Install this blower in any mounting position. Do not block the flow of cooling air over the blower and motor.

PLUMBING - Use the threaded pipe ports for connection only. They will not support the plumbing. Be sure to use the same or larger size pipe to prevent air flow restriction and overheating of the blower. When installing fittings, be sure to use pipe thread sealant. This protects the threads in the blower housing and prevents leakage. Dirt and chips are often found in new plumbing. Do not allow them to enter the blower.

NOISE - Mount the unit on a solid surface that will not increase the sound. This will reduce noise and vibration. We suggest the use of shock mounts or vibration isolation material for mounting.

ROTATION - The Gast Regenair Blower should only rotate clockwise as viewed from the electric motor side. The casting has an arrow showing the correct direction. Confirm the proper rotation by checking air flow at the IN and OUT ports. If needed reverse rotation of three phase motors by changing the position of any two of the power line wires.

OPERATION

⚠ *WARNING Solid or liquid material exiting the blower or piping can cause eye damage or skin cuts. Keep away from air stream.*

⚠ *WARNING - Gast Manufacturing Corporation will not knowingly specify, design or build any blower for installation in a hazardous, combustible or explosive location without a motor conforming to the proper NEMA or U. L. standards.* Blowers with standard TEFC motors should never be utilized for soil vapor extraction applications or where local state and/or Federal codes specify the use of explosion-proof motors (as defined by the National Electric Code, Articles 100,500 c1990).

⚠ *CAUTION Attach blower to solid surface before starting to prevent injury or damage from unit movement.* Air containing solid particles or liquid must pass through a filter before entering the blower. Blowers must have filters, other accessories and all piping attached before starting. Any foreign material passing through the blower may cause internal damage to the blower.

⚠ *CAUTION Outlet piping can burn skin. Guard or limit access.* Mark *"CAUTION Hot Surface. Can Cause Burns".* Air temperature increases when passing through the blower. When run at duties above 50 in. H_2O, metal pipe may be required for hot exhaust air. The blower must not be operated above the limits for continuous duty. Only models R3105N-50, R4110N-50 and R4310P-50 can be operated continuously with no air flowing through the blower. Other units can only be run at the rating shown on the model number label. Do not Close off inlet (for vacuum) to reduce extra air flow. This will cause added heat and motor load. Blower exhaust air in excess of 230°F indicates operation in excess of rating which can cause the blower to fail.

ACCESSORIES ...Gast pressure gauge AJ496 and vacuum gauges AJ497 or AE134 show blower duty. The Gast pressure/vacuum relief valve, AG258, will limit the operating duty by admitting or relieving air. It also allows full flow through the blower when the relief valve closes.

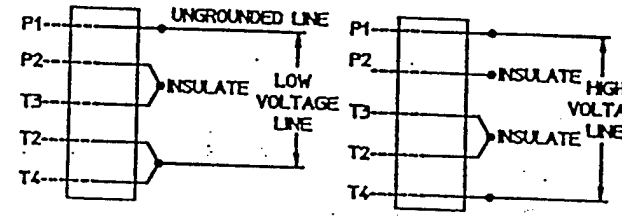
SERVICING

⚠ *WARNING* *To retain their sealed construction they should be serviced by Gast authorized service centers ONLY.* These models are sealed at the factory for very low leakage.

⚠ *WARNING* *Turn off electric power before removing blower from service. Be sure rotating parts have stopped. Electric shock or severe cuts can result.* Inlet and exhaust filters attached to the blower may need cleaning or replacement of the elements. Failure to do so will result in more pressure drop, reduced air flow and hotter operation of the blower. The outside of the unit requires cleaning of dust and dirt. The inside of the blower also may need cleaning to remove foreign material coating the impeller and housing. This should be done at a Gast Authorized Service Center. This buildup can cause vibration, failure of the motor to operate or reduced flow.

KEEP THIS INFORMATION WITH THIS BLOWER.
REFER TO IT FOR SAFE INSTALLATION,
OPERATION OR SERVICE.

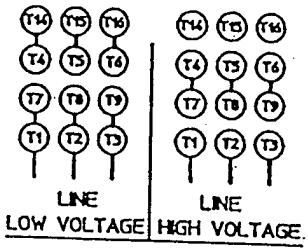
MOTOR WIRING DIAGRAM FOR R4110N-50 & R3105N-50



>>* WARNING
THIS MOTOR IS THERMALLY PROTECTED AND WILL AUTOMATICALLY RESTART WHEN PROTECTOR RESETS. ALWAYS DISCONNECT POWER SUPPLY BEFORE SERVICING.

MOTORS WIRING DIAGRAM FOR R4310P-50

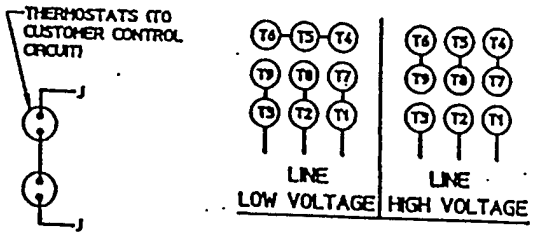
TO REVERSE ROTATION, INTERCHANGE THE EXTERNAL CONNECTIONS TO ANY TWO LEADS.



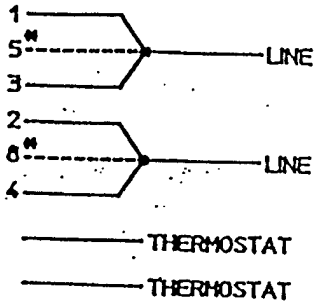
>>* WARNING
THIS MOTOR IS THERMALLY PROTECTED AND WILL AUTOMATICALLY RESTART WHEN PROTECTOR RESETS. ALWAYS DISCONNECT POWER SUPPLY BEFORE SERVICING.

MOTORS WIRING DIAGRAM FOR R5325R-50, R6350R-50, R6P355R-50, & R7100R-50

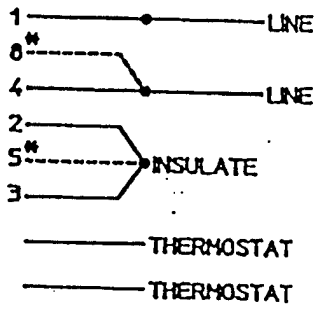
TO REVERSE ROTATION, INTERCHANGE THE EXTERNAL CONNECTIONS TO ANY TWO LEADS.



MOTOR WIRING DIAGRAM FOR R5125Q-50 & R4P115N-50



LOW VOLTAGE

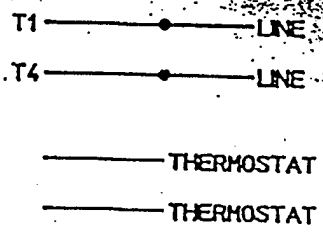


HIGH VOLTAGE

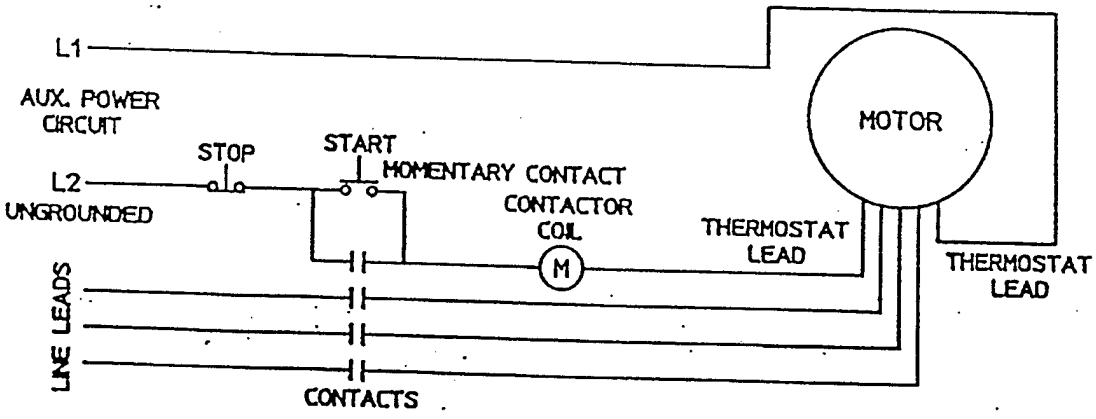
* R5125Q-50 BLOWERS PRODUCED AFTER SEPTEMBER 1992 (SER. NO. 0992) DO NOT HAVE MOTOR LEADS 5 & 8.

MOTOR WIRING DIAGRAM FOR R6130Q-50 & R6P155Q-50

CONNECT THERMOSTAT TO MOTOR PROTECTION CIRCUIT



CONNECTION FOR THERMOSTAT MOTOR PROTECTION



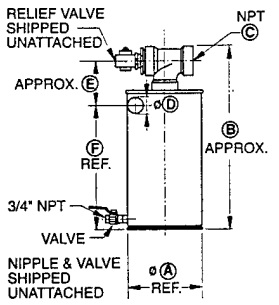
TERMOSTATS TO BE CONNECTED IN SERIES WITH CONTROL AS SHOWN. MOTOR FURNISHED WITH AUTOMATIC THERMOSTATS RATED A.C. 115-600V. 720VA

AK811 rev. E

ACCESSORIES

Moisture Separators

Moisture separators remove liquids from the gas stream in a vacuum process, helping protect the blower from corrosion and a buildup of mineral deposits.

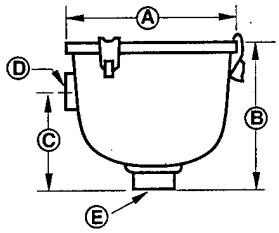


Part No.	Liq. Cap. (gal.)	A(dia.)	Dim. B	C(NPT)	D(dia.)	Dim. E	Dim. F
RMS160	10	14.8"	37.5"	2"	2"	7.5"	26.6"
RMS200	19	19.7"	35"	2"	2"	7.5"	26.6"
RMS300	19	19.7"	35"	2.5"	2.5"	7.5"	26.6"
RMS400	40	24"	44"	3"	3"	9.7"	29"

Part No.	Product Type	Description	Used On
RMS160	Moisture separator	10 gallon liquid carrying capacity	R3, R4, R4P, R5 Blowers
RMS200	Moisture separator	19 gallon liquid carrying capacity	R4, R4P, R5, R6 Blowers
RMS300	Moisture separator	19 gallon liquid carrying capacity	R5, R6, R6P Blowers
RMS400	Moisture separator	40 gallon liquid carrying capacity	R6P, R7 Blowers
—	Float switch	Consult factory for appropriate style	RMS Series-Separators

Filters

Since the blower impeller passes very close to the housing, it is always wise to have an in-line or inlet filter to ensure trouble free life.



In-line (for vacuum)

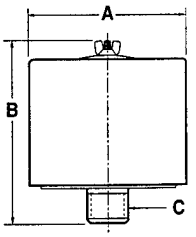
Part No.	Dim. A	Dim. B	Dim. C	Dim. D	Dim. E
AJ151C	7.38"	6.81"	4.62"	1-1/4" FPT	1-1/4" FPT
AJ151D	7.38"	6.81"	4.62"	1-1/2" FPT	1-1/2" FPT
AJ151E	8.75"	10.25"	5.00"	2" FPT	2" FPT
AJ151G	8.00"	10.25"	5.50"	2-1/2" FPT	2-1/2" FPT
AJ151H	14.00"	26.50"	18.13"	3" MPT	3" MPT
AJ151L	14.00"	27.13"	18.50"	4" MPT	4" MPT

MPT = Male Pipe Thread FPT = Female Pipe Thread All are heavy-duty for high amounts of particulates.
Inlet filters for REGENAIR® blowers are drip-proof when mounted as shown.

For Vacuum Service

AJ151C	In-line filter	10 micron filter (replacement element AJ135E)	R3 Blower, R1H
AJ151D	In-line filter	10 micron filter (replacement element AJ135E)	R4, R4P, R3H Blowers, R2H
AJ151E	In-line filter	10 micron filter (replacement element AJ135F)	R5, R4H Blowers
AJ151G	In-line filter	10 micron filter (replacement element AJ135G)	R6, R6P Blowers, R7H, R8H, R9H
AJ151H	In-line filter	10 micron filter (replacement element AJ135C)	R7 Blower
AJ151L	In-line filter	10 micron filter (replacement element AJ135C)	R8M Blower

Inlet (for pressure units only)



Part No.	Dim. A	Dim. B	Dim. C
AJ126C	6.00"	7.12"	1-1/4" MPT
AJ126D	7.70"	7.25"	1-1/2" MPT
AJ126F	10.63"	4.81"	2" FPT
AJ126G	10.00"	13.12"	2-1/2" MPT
AJ126L	10.00"	14.62"	4" MPT

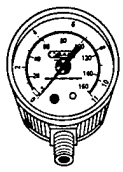
MPT = Male Pipe Thread FPT = Female Pipe Thread All are heavy-duty for high amounts of particulates.
Inlet filters for REGENAIR® blowers are drip-proof when mounted as shown.

For Compressor–Inlet

AJ126C	Inlet filter	10 micron filter (replacement element AJ134C)	R3 Blower, R1H, 2067, 2567
AJ126D	Inlet filter	10 micron filter (replacement element AJ134E)	80 Series, 6066, 1290, R4, R4P, R5, R3H Blowers
AJ126F	Inlet filter	25 micron filter (replacement element AG340)	R6, R6P, R4H Blowers
AJ126G	Inlet filter	10 micron filter (replacement element AJ135A)	R7 Blower, R7H, R8H
AJ126L	Inlet filter	10 micron filter (replacement element AJ135H)	R8H Blower
AL355	Inlet filter	10 micron filter	0823

Pressure-Vacuum Gauge

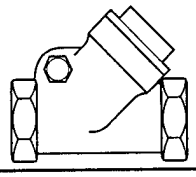
To monitor the system performance so maximum duties are not exceeded. Using two gauges (one on each side of the filter) is a great way to know when the filter needs servicing.



AJ497	Vacuum gauge	0-60" H_2O, 1/4" NPT connection	Blowers
AE134	Vacuum gauge	0-160" H_2O, 1/4" NPT connection	Blowers
AE134F	Vacuum gauge	0-15" HG, 1/4" NPT connection	H Series Blowers
AA644B	Pressure gauge	0-30 psi, 1/4" NPT	80 Series, 2567, 2067, 6066, 0823
AE133	Pressure gauge	0-160" H_2O, 1/4" NPT connection	Blowers
AE133A	Pressure gauge	0-200" H_2O, 1/4" NPT connection	Blowers
AE133F	Pressure gauge	0-15 psi, 1/4" NPT connection	R3H, R4H Blowers
AJ496	Pressure gauge	0-60" H_2O, 1/4" NPT connection	SVE Blowers

Check Valve

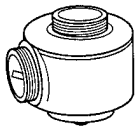
Designed to prevent back-wash of fluids that would enter the blower. Also prevents air back-streaming if needed. Can be mounted with discharge either vertical or horizontal. Valve will open with 3" of water pressure.



AH326D	Check valve	1-1/2" NPT (3" H_2O cracking pressure)	Blowers
AH326F	Check valve	2" NPT (3" H_2O cracking pressure)	Blowers
AH326G	Check valve	2-1/2" NPT (3" H_2O cracking pressure)	R7 Blower

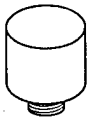
Relief Valve

By setting a relief valve at a given pressure/vacuum you can ensure excessive duties will not harm the blower or products in your application.



AG258

AN225

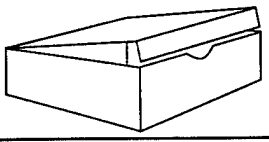


PV Series

AA307	Relief valve	For pressure, 3/4" NPT, adjustable 2-25 psi	6066, 2567 Series
AA600	Relief valve	For pressure, 3/8" NPT, adjustable 2-30 psi	0823
AG258	Relief valve	1-1/2" NPT adjustable 30-170" H_2O, vac. or press., 200 CFM max.	Blowers
AG258F	Relief valve	2-1/2" NPT adjustable for higher flows, vacuum or pressure	Blowers
PV065	Relief valve	For pressure, pre-set for 6.5 psi, 1-1/4" NPT connection (60Hz)	R3H Blower
PV072	Relief valve	For pressure, pre-set for 7.2 psi, 1-1/4" NPT connection (60Hz)	R3H Blower
PV084	Relief valve	For pressure, pre-set for 8.4 psi, 1-1/4" NPT connection (50Hz)	R4H Blower,R8H, R9H
PV091	Relief valve	For pressure, pre-set for 9.1 psi, 1-1/4" NPT connection (50Hz)	R4H Blower, R9H
PV098	Relief valve	For pressure, pre-set for 9.8 psi, 1-1/4" NPT connection (50Hz)	R7H Blower
PV102	Relief valve	For pressure, pre-set for 10.2 psi, 1-1/4" NPT connection (60Hz)	R7H Blower
AN225	Relief valve	15-45 cfm, 3/4" NPT connection, adjustable 0-20 psi	2080, 3080, 4080 Series

Service Kit

If pump performance on rotary vane models diminishes, installation of the Service Kit replacement parts will have it performing like new again.



K479A	Service Kit	Includes items for unit repair	0823 Model
K504	Service Kit	Includes items for unit repair	6066, 1290 (uses 2)
K583	Service Kit	Includes items for unit repair	2567 Models
K584	Service Kit	Includes items for unit repair	2080, 3080, 4080 Models
K585	Service Kit	Filter/Muffler Kit only	2080, 3080, 4080 Models

North American Representatives and Distributors

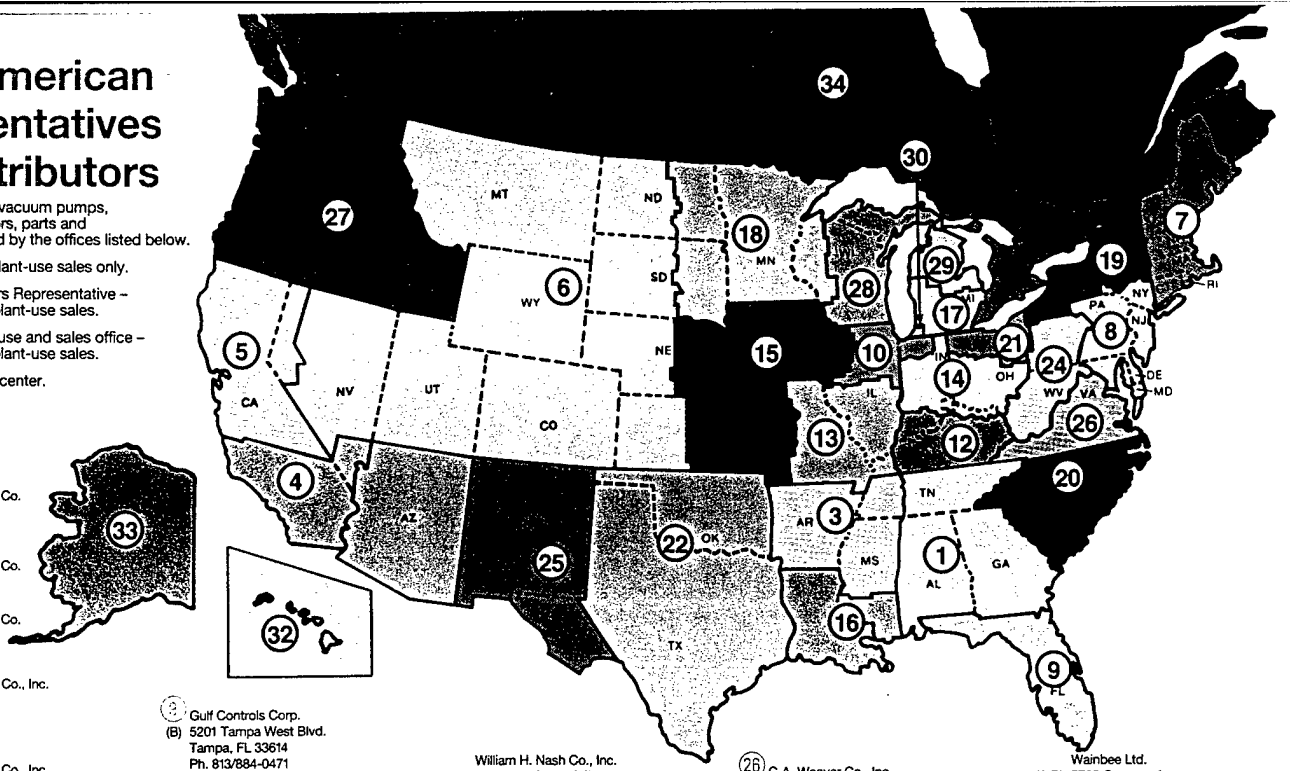
A substantial stock of vacuum pumps, compressors, air motors, parts and accessories are carried by the offices listed below.

(A) Distributor–plant-use sales only.

(B) Manufacturers Representative – O.E.M. and plant-use sales.

(C) Gast warehouse and sales office – O.E.M. and plant-use sales.

(D) Gast service center.



(1) James E. Watson & Co.
(B) 29 Doran Ave.
Marietta, GA 30060
Ph. 404/422-1154

James E. Watson & Co.
Birmingham, AL
Ph. 205/663-6678

James E. Watson & Co.
Nashville, TN
Ph. 615/331-5716

(3) Franklin Electrofluid Co., Inc.
(B) 3854 Watman
Memphis, TN 38118
Ph. 901/362-7504
Ph. 1-800-238-7500

Franklin Electrofluid Co., Inc.
(B) 8900 Crystal Hill Road
North Little Rock, AR 72113
AR only 1-800-272-5665
Ph. 501/771-4170

Franklin Electrofluid Co., Inc.
5609 South 14th Street
Ft. Smith, AR 72901
Ph. 501/646-7448
Ph. 1-800-264-7406

(4) Brenner-Fiedler & Assoc., Inc.
(B,D) 13824 Bentley Place
Cerritos, CA 90701
Ph. 310/404-2721 &
Ph. 714/521-6280
Ph. 1-800-843-5558

Brenner Fiedler & Assoc., Inc.
(B) San Diego, CA
Ph. 619/232-9152
Ph. 1-800-843-5558

Brenner Fiedler & Assoc., Inc.
(B) 2117 South 48th Street #102
Tempe, AZ 85282
Ph. 1-800-638-0394

(5) TECO Pneumatic, Inc.
(B) 1069 Serpentine Lane
Pleasanton, CA 94566
Ph. 510/426-8500

(6) Fiero Fluid Power, Inc.
(B) Suite 104
10515 East 40th Ave.
Denver, CO 80239
Ph. 303/373-2600

Fiero Fluid Power, Inc.
(B) 2155 South Main
Salt Lake City, UT 84115
Ph. 801/467-4622

(7) Ohlheiser Corp.
(B) 17 Rose Ave.
West Hartford, CT 06133-0332
Connecticut only 203/953-7632
New England States 1-800-858-9368

(8) GAST
Gast Mfg. Corp.
(C,D) Eastern Sales Office
505 Washington Ave.
Carlstadt, NJ 07072
Ph. 201/933-8484
Ph. 212/563-1870 (NYC)

Dees Corp.
(A) 8860 Kelso Dr.
Baltimore, MD 21221
Ph. 410/574-2900

Die-A-Matic, Inc.
(A) 119 Brown St.
Pittston (Wilkes-Barre), PA 18640
Ph. 717/655-6831

Die-A-Matic, Inc.
(A) 650 N. State St.
York, PA 17403
Ph. 717/846-9300

Van-Air & Hydraulics, Inc.
(A) Philadelphia, PA
Ph. 215/923-2575

Van-Air & Hydraulics, Inc.
(A) 525 E. Woodlawn Ave.
Maple Shade, NJ 08052
Ph. 609/779-7300

(9) Gulf Controls Corp.
(B) 5201 Tampa West Blvd.
Tampa, FL 33614
Ph. 813/884-0471
Ph. 1-800-282-9125

(10) GAST
Gast Midwestern Sales Office
(C) 755 N. Edgewood
Wood Dale, IL 60191
Ph. 708/860-7477

(12) D & F Distributors
(B) 6309 Ulrich Avenue
Louisville, KY 40219
Ph. 502/968-0107
Ph. 1-800-45-PUMPS

D & F Distributors, Inc.
(B) 1144 Indy Court
Evansville, IN 47711
Ph. 812/867-2441
Ph. 1-800-45-PUMPS

(13) John Henry Foster Co. Inc.
(B) 4700 Lebourget Drive
St. Louis, MO 63134-0820
Ph. 314/427-0600
Ph. 1-800-444-0522

(14) Isaacs Fluid Power Equipment Company
(B) 8746 East 33rd Street
Indianapolis, IN 46226
Ph. 317/898-3486

Isaacs Fluid Power Equipment Company
Ft. Wayne, IN
Ph. 219/747-9804

Isaacs Fluid Power Equipment Company
(B) 1023 E. Fourth St.
Dayton, OH 45402
Ph. 513/228-7774

Isaacs Fluid Power Equipment Company
(B) 1840 Amberlawn Dr.
Cincinnati, OH 45237
Ph. 513/761-8855

Isaacs Fluid Power Equipment Company
(B) 929 Eastwind Drive, Suite 205
Westerville, OH 43081
Ph. 614/895-8540

(15) Skarda Equipment Co., Inc.
(B) 2563 Farnam
Omaha, NE 68131
Ph. 1-800-228-9750
Ph. 402/422-0430

Skarda Equipment Co., Inc.
(B) 3545 Third Ave.
Marion, IA 52302
Ph. 1-800-228-9750

Skarda Equipment Co., Inc.
Des Moines, IA
Ph. 1-800-228-9750

Skarda Equipment Co., Inc.
(B) 10139 Kaw Dr.
Edwardsville, KS 66113
Ph. 1-800-228-9750

Skarda Equipment Co., Inc.
(B) 313 N. Mathewson
Wichita, KS 67214
Ph. 1-800-228-9750

(16) D & L Pumps, Inc.
(B) 2845 Sharon Street
Kenner, LA 70062
Ph. 504/467-2490

(17) William H. Nash Co., Inc.
(B) 23910 Freeway Park Drive
Farmington Hills, MI 48335
Ph. 810/477-5800

William H. Nash Co., Inc.
(B) 4134 36th Street S.E.
Grand Rapids, MI 49512
Ph. 616/949-4900

William H. Nash Co., Inc.
Flushing, MI
Ph. 810/732-7272

(18) Midwest Machine Tool Supply
230 Commerce Circle South
Minneapolis, MN 55432
Ph. 612/571-3550
Ph. 1-800-327-9523

(19) Kinequip, Inc.
(B) 365 Old Niagara Falls Blvd.
Buffalo, NY 14228-1636
Ph. 716/694-5000
Ph. 1-800-982-8894

Kinequip, Inc.
Johnstown, NY
Ph. 1-800-982-8894

Kinequip, Inc.
(B) Rochester, NY
Ph. 716/272-1590
Ph. 1-800-982-8894

Kinequip, Inc.
(B) Syracuse, NY 13211
Ph. 315/458-4115
Ph. 1-800-982-8894

(20) Hydraulic & Pneumatic Sales
(B) 11100 Park Charlotte Blvd.
Charlotte, NC 28241
Ph. 704/588-3234

(21) RAF Fluid Power, Inc.
(B) 23775 Mercantile Road
Cleveland, OH 44122-5990
Ph. 216/464-8990

(22) Southwestern Controls
(B) 9912 B. East 45th Place
Tulsa, OK 74146-4752
Ph. 918/663-6777
Ph. 1-800-658-1570

Southwestern Controls
(B) 6720 Sands Point
Houston, TX 77074
Ph. 713/777-2626
Ph. 1-800-444-9368

Southwestern Controls
(B) 8808 Sovereign Row
Dallas, TX 75247
Ph. 214/638-4266
Ph. 1-800-444-9367

Southwestern Controls
(B) 859 Isom Road
San Antonio, TX 78216-4035
Ph. 210/340-4111

(24) Allegheny Fluid Power, Inc.
(B) 112 Douglas Road
Sewickley, PA 15143
Ph. 412/367-5894

(25) Mesa Equipment & Supply Company
(B) 3820 Commons, N.E.
Albuquerque, NM 87109
Ph. 505/345-0284

Mesa Equipment & Supply Company
(B) 1342 Lomaland Drive
El Paso, TX 79935
Ph. 915/594-1414

(26) C.A. Weaver Co., Inc.
(B) 2420 Grenoble Road
Richmond, VA 23294
Ph. 804/672-6501

C.A. Weaver Co., Inc.
(B) 7562 Hi Tech Rd.
Roanoke, VA 24019
Ph. 703/563-9761

C.A. Weaver Co., Inc.
(B) 2430 Alabama Avenue
Norfolk, VA 23513
Ph. 804/857-8700

(27) Air-Oil Products Corp.
(B) 6353 Sixth Ave. South
Seattle, WA 98108-3437
Ph. 206/767-7750
Ph. 1-800-282-2672
Fax: 206/762-4736

Air-Oil Products Corp.
(B) 2400 E. Burnside St.
Portland, OR 97214
Ph. 503/234-0866
Ph. 1-800-242-2672

Air-Oil Products Corp.
(B) 865 Conger Street
Eugene, OR 97401
Ph. 503/485-2022
Ph. 1-800-322-2672

(28) Fluid System Components Inc.
(B) 3154 Gross St.
Green Bay, WI 54307
Ph. 414/337-0234

Fluid System Components Inc.
(B) 2315 South 170th Street
New Berlin, WI 53151-2701
Ph. 414/827-2700

(29) J.E.M. Fluid Power, Inc.
(B) 2182 Dam Rd.
West Branch, MI 48661
Ph. 517/345-1180

(30) GAST
Gast Mfg. Corp.
(C) 2300 Highway M-139
(D) Benton Harbor, MI 49023-0097
Ph. 616/926-6171

(32) C & F Machinery
(A) 91-060 Hanua Street
Kapolei, Hawaii 96707-1777
Ph. 808/682-1541

(33) Garness Industries, Inc.
(B) 6317 Nielson Way
Anchorage, AK 99518
Ph. 907/562-2933

(34) CANADA

ONTARIO

Wainbee Ltd.
Windsor
Ph. 1-800-265-0929

Wainbee Ltd.
(B) 1590 Liverpool Court
Ottawa, Ontario K1B 4L2
Ph. 613/744-1720

Wainbee Ltd.
(A,D) 5789 Coopers Ave.
Mississauga, Ontario L4Z 3S6
Ph. 905/568-1700
Fax: 905/568-0083

Wainbee Ltd.
(B) Unit 14
65 Trillium Park Place
Kitchener, Ont. N2E 1X1
Ph. 519/748-5391

Wainbee Ltd.
(B) 1909 Oxford Street East, Unit 45
London, Ont. N5V 4L9
Ph. 519/451-6266
Fax: 519/451-5566

QUEBEC

Wainbee Ltd.
(A,D) 215 Brunswick Blvd.
Pointe Claire, P.Q. H9R 4R7
Ph. 514/697-8810

Wainbee Ltd.
(B) 1990 Quest Blvd. Charest
Quebec City, P.Q. G1N 4K8
Ph. 418/683-1956

Wainbee Ltd.
(B) 1932 St. Paul Blvd.
Chicoutimi, P.Q. G7K 1H2
Ph. 418/698-4884

BRITISH COLUMBIA

Wainbee Ltd.
(B) 2231 Vauxhall Place
Richmond, B.C. V6V 1Z5
Ph. 604/278-4288
Ph. 1-800-663-9829

ALBERTA

Wainbee Ltd.
(B) 10336 59th Avenue
Edmonton, Alta, T6H 1E6
Ph. 403/434-9528

Wainbee Ltd.
(B) 7407 44th St. S.E.
Calgary, Alta, T2C 3C8
Ph. 403/236-1133

MANITOBA

Wainbee Ltd.
(B) 1393 Border St. #4
Winnipeg, Man. R3H 0N1
Ph. 204/632-4558
Ph. 1-800-663-1393

MARITIME PROVINCES

Wainbee Ltd.
(B) 10 Thornhill Drive, Suite #5
Dartmouth, Nova Scotia
Halifax B3B 1S1
Ph. 902/468-1787
Ph. 1-800-667-1787

SASKATOON

Wainbee, Ltd.
437 34th Street
Saskatoon, Sask. SKS 0S9
Ph. 306/652-1433

NORTH BAY

Wainbee, Ltd.
1954 Main Street West
North Bay, Ont. P1B 8K5
Ph. 705/472-4244
Ph. 1-800-461-9534

GAST®

CONVERSION CHARTS

PRESSURE CONVERSION TABLE

Lbs. Per Sq. Inch	Atmospheres	Inches of Mercury	Millimeters of Mercury	Inches of Water	Meters of Water	Milli Bars	Kilopascals
1	.0680	2.036	51.71	27.73	.7037	69.0	6.895
14.70	1	29.92	760	407	10.33	1013.3	101.36
.4912	.0334	1	25.4	13.6	.3452	33.86	3.387
.0193	.001315	.03937	1	.5358	.0136	1.33	.13307
.0361	.00246	.0735	1.868	1	.0254	2.49	.24891
1.422	.0967	2.895	73.55	39.37	1	97.98	9.8047
14.50	.0009869	.02953	.750	.4018	.01021	1	.09998
.145	.00986	.29529	7.4996	4.0174	.10206	10.01	1

VOLUME FLOW CONVERSION TABLE

cfm	cfh	gpm	m^3h	l/s
1	60	7.4805	1.6990	.47195
1/60	1	.12468	.02832	.007866
.13368	8.0208	1	.22712	.06309
.58858	35.315	4.4029	1	1/3.6
2.1189	127.13	15.850	3.6	1

Power and Heat Flow Conversion Table

hp(U.S.)	ft.lb/min	Btu/hr	Btu/min	W	kcal/min
1	33000	2544.4	42.407	745.70	10.686
.000030303	1	.07710	.001285	.02260	.0003238
.0003930	12.969	1	1/60	.29307	.004200
.02358	778.17	60	1	17.584	.25200
.00134	44.254	3.4121	.05687	1	.01433
.09358	3088.0	238.10	3.9683	69.780	1

Temperature Conversion Chart

°C = ⅝ (°F -32) **°F = (⅝°C) +32**

Absolute Kelvin = °C +273.15 **Rankine °F = +459.67**

TABLE EXAMPLE:
To Convert 100 °C to °F look up 100 read left
To Convert 100 °F to °C look up to 100 read right

to °F	From	to °C
-148.0	**-100**	-73.33
-130.0	**-90**	-67.78
-112.0	**-80**	-62.22
-94.0	**-70**	-56.67
-76.0	**-60**	-51.11
-58.0	**-50**	-45.56
-40.0	**-40**	-40.00
-36.4	**-38**	-38.89
-32.8	**-36**	-37.78
-29.2	**-34**	-36.67
-25.6	**-32**	-35.56
-22.0	**-30**	-34.44
-18.4	**-28**	-33.33
-14.8	**-26**	-32.22
-11.2	**-24**	-31.11
-7.6	**-22**	-30.00
-4.0	**-20**	-28.89
-0.4	**-18**	-27.78
+3.2	**-16**	-26.67
+6.8	**-14**	-25.56
+10.4	**-12**	-24.44
+14.0	**-10**	-23.33
+17.6	**-8**	-22.22
+21.2	**-6**	-21.11
+24.8	**-4**	-20.00
+28.4	**-2**	-18.89
+32.0	**0**	-17.78
+35.6	**+2**	-16.67
+39.2	**+4**	-15.56
+42.8	**+6**	-14.44
+46.4	**+8**	-13.33

to °F	From	to °C
+50.00	**+10**	-12.22
+53.6	**+12**	-11.11
+57.2	**+14**	-10.00
+60.8	**+16**	-8.89
+64.4	**+18**	-7.78
+68.0	**+20**	-6.67
+71.6	**+22**	-5.56
+75.2	**+24**	-4.44
+78.8	**+26**	-3.33
+82.4	**+28**	-2.22
+86.0	**+30**	-1.11
+89.6	**+32**	0.00
+93.2	**+34**	+1.11
+96.8	**+36**	+2.22
+100.4	**+38**	+3.33
+104.0	**+40**	+4.44
107.6	**42**	5.56
111.2	**44**	6.67
114.2	**46**	7.78
118.4	**48**	8.89
122.0	**50**	10.00
125.6	**52**	11.11
129.2	**54**	12.22
132.8	**56**	13.33
136.4	**58**	14.44
140.0	**60**	15.56
143.6	**62**	16.67
147.2	**64**	17.78
150.8	**66**	18.89
154.4	**68**	20.00
158.0	**70**	21.11

to °F	From	to °C
161.6	**72**	22.22
165.2	**74**	23.33
168.8	**76**	24.44
172.4	**78**	25.56
176.0	**80**	26.67
179.6	**82**	27.78
183.2	**84**	28.89
186.8	**86**	30.00
190.4	**88**	31.11
194.0	**90**	32.22
197.6	**92**	33.33
201.2	**94**	34.44
204.8	**96**	35.56
208.4	**98**	36.67
212.0	**100**	37.78
230.0	**110**	43.33
248.0	**120**	48.89
266.0	**130**	54.44
284.0	**140**	60.00
302.0	**150**	65.56
320.0	**160**	71.11
338.0	**170**	76.67
356.0	**180**	82.22
374.0	**190**	87.78
392.0	**200**	93.33
410.0	**210**	98.89
428.0	**220**	104.44
446.0	**230**	110.00
464.0	**240**	115.56
482.0	**250**	121.11

Warranty

REGARDLESS OF CAUSE, if a product you buy from this brochure does not work right, Gast will repair or replace it once, at no charge, for up to one year from the date of shipment from the factory. In the course of repair or replacement, Gast may send you written recommendations on how to prevent a problem from happening again. Gast reserves the right to withdraw this warranty if you do not follow these recommendations. Customer is responsible for freight charges both to and from Gast in all cases. This warranty does not apply to electric motors, electrical controls, and gasoline engines, which Gast obtains from other manufacturers. A motor or engine carries only the warranty of the company that makes it.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, INCLUDING THE WARRANTY OF MERCHANTABILITY AND OF FITNESS FOR ANY PARTICULAR PURPOSE. GAST'S LIABILITY IS IN ALL CASES LIMITED TO THE REPLACEMENT PRICE OF ITS PRODUCT. GAST SHALL NOT BE LIABLE FOR ANY OTHER DAMAGES, WHETHER CONSEQUENTIAL, INDIRECT, OR INCIDENTAL, ARISING FROM THE SALE OR USE OF ITS PRODUCTS.

Gast's sales personnel may modify this warranty, but only by signing a specific, written description of any modifications.

DISCLAIMER

The information presented in this catalog is based on technical data and test results of nominal units. It is believed to be accurate and is offered as an aid in the selection of Gast products. It is the user's responsibility to determine suitability of the product for his intended use and the user assumes all risk and liability whatsoever in connection therewith.

APPENDIX C

DATA COLLECTION SHEETS

DATA COLLECTION SHEET
REGENERATIVE BLOWER SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AFB, SOUTH CAROLINA

Date	Time	Blower Functioning Upon Arrival? (Y/N)	Inlet Vacuum (inches H_2O)	Outlet Temperature (° F)	Outlet Pressure (inches H_2O)	Power Usage (kw/hr)	Comments	Checked by (initials)

DATA COLLECTION SHEET
REGENERATIVE BLOWER SYSTEM
SWMU 55 (SITE FT-03)
CHARLESTON AFB, SOUTH CAROLINA

Date	Time	Blower Functioning Upon Arrival? (Y/N)	Inlet Vacuum (inches H_2O)	Outlet Temperature (° F)	Outlet Pressure (inches H_2O)	Power Usage (kw/hr)	Comments	Checked by (initials)